Precision Cooling
For *Business-Critical Continuity™*

Liebert® Air Cooled, Direct Drive Condensers

User Manual - 50/60Hz

EMERSON
Network Power

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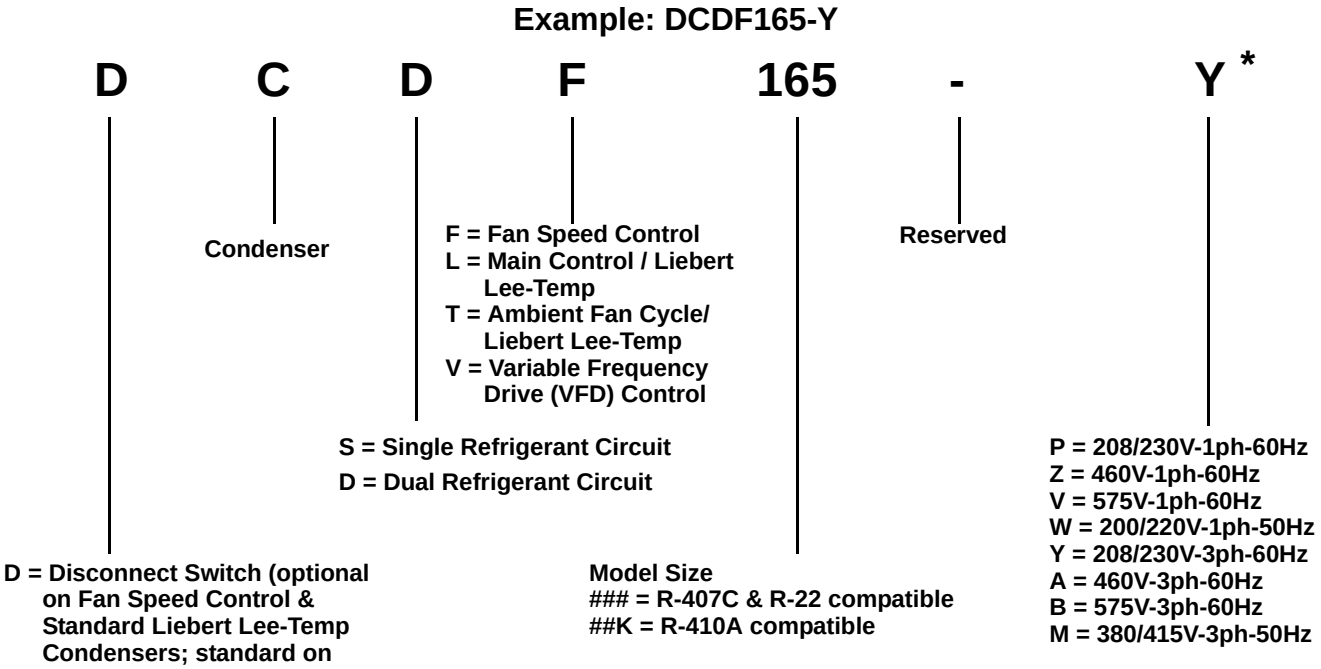
1.0 INTRODUCTION

1.1 Product Description and Features

The Liebert condenser is low-profile direct-drive propeller fan-type air cooled unit suitable for mounting outdoors. It provides for the heat rejection of either one or two separate refrigeration circuits, matching heat rejection capacity varying with the outdoor ambient temperatures and with each corresponding compressors heat rejection requirements. Constructed with an aluminum cabinet and a copper-tube aluminum fin coil, the unit is quiet and corrosion resistant. The condenser is quickly and easily installed, because all internal wiring is completed at the factory with only electrical connections to be made at the job site. All electrical connections and controls are enclosed in an integral weatherproof section of the condenser.

Figure 1 Liebert two-fan condenser

Figure 2 Product model nomenclature


Example: DCDF165-Y
D C D F 165 - Y *
Condenser
F = Fan Speed Control
L = Main Control / Liebert Lee-Temp
T = Ambient Fan Cycle/ Liebert Lee-Temp
V = Variable Frequency Drive (VFD) Control
Reserved
S = Single Refrigerant Circuit
D = Dual Refrigerant Circuit
P = 208/230V-1ph-60Hz
Z = 460V-1ph-60Hz
V = 575V-1ph-60Hz
W = 200/220V-1ph-50Hz
Y = 208/230V-3ph-60Hz
A = 460V-3ph-60Hz
B = 575V-3ph-60Hz
M = 380/415V-3ph-50Hz
D = Disconnect Switch (optional on Fan Speed Control & Standard Liebert Lee-Temp Condensers; standard on Liebert Quiet-Line)
T = Surge Protection Device (SPD, internal) & Disconnect Switch; available only on VFD Control condensers
Model Size
= R-407C & R-22 compatible
##K = R-410A compatible
NOT ALL POSSIBLE COMBINATIONS OF MODELS, CONTROLS AND VOLTAGES ARE AVAILABLE.
* Single-phase voltage is only voltage available as standard on Fan Speed Control 1-fan condensers
* Three-phase voltage is only voltage available as standard on condensers with VFD Control, Liebert Lee-Temp receivers, and Fan Speed Control (2-8 fan models only).
* VFD Control Condensers are not available in 575-3-60.

1.2 Head Pressure Control Types

1.2.1 Fan Speed

Fan speed control utilizes a wave-chopper control to vary the air volume over the condenser coil, based on refrigerant head pressure. The fan motor next to the electrical panel (two fans on 6-fan and 8-fan models) is a single-phase, permanent split capacitor motor with motor speed adjusted in response to refrigerant pressure. The balance of fans on multi-fan units cycle on ambient thermostats. The control system provides refrigerant head pressure control for outdoor ambients as low as -20°F (-28.9 °C).

1.2.2 Variable Frequency Drive

VFD Condenser control system utilizes a variable frequency drive, inverter duty fan motor operating from 0% to 100% motor RPM based on head pressure, sensed by refrigerant pressure transducers. VFD, ambient-temperature thermostat(s), motor overload protection and electrical control circuit are factory-wired in the integral control panel. VFD controls the fan adjacent to the connection end of the condenser and remains energized with active compressor operation. The balance of fans on multi-fan units cycle on ambient thermostats. This system provides refrigerant head pressure control for outdoor ambients as low as -20°F (-28.9°C).

1.2.3 Liebert Lee-Temp™ Refrigerant Control

The Liebert Lee-Temp head pressure control system is designed to maintain proper operating head pressures in outdoor temperatures down to -30°F (-34.4°C). The condensers utilize head pressure control valves, extra refrigerant and insulated refrigerant receivers with heater pads. It works by flooding the condenser coil with liquid refrigerant to a level that balances the system condensing requirements with the condenser coil surface available to reject the system heat. During the summer, the system requires the entire condenser coil surface for heat rejection and most of the refrigerant is stored in a receiver. In the winter, the same amount of heat can be rejected by only a fraction of the coil surface. As head pressure begins to fall, the control valve restricts the flow of liquid refrigerant exiting from the condenser. This extra liquid refrigerant reduces the effective condenser surface area available for heat transfer. The head pressure control valve also bypasses hot gas into the receiver to warm the liquid and maintain liquid pressure for proper operation of the expansion valve. Condenser fan controls are either fan cycling on ambient temperature or constant on. Liebert Lee-Temp control is required for Liebert Quiet-Line Condensers.

1.3 Sound Level Options

1.3.1 Standard Condenser

All Fan Speed and VFD Condensers are standard condensers with moderate operating sound levels. Liebert Lee-Temp condensers with standard-size coils matching Fan Speed and VFD coil sizes are standard sound level condensers.

1.3.2 Liebert Quiet-Line Condenser

Liebert Quiet-Line Condensers can help your facility meet the strictest noise codes and do so at less cost than traditional condensers with acoustical shielding. The Liebert Quiet-Line Condensers utilize the same reliable construction features of the standard condensers and have oversized coils and slower speed fan motors which yield the required heat rejection needed at significantly lower sound levels. Liebert Lee-Temp control is required for Liebert Quiet-Line Condensers.

1.4 Surge Protection Device

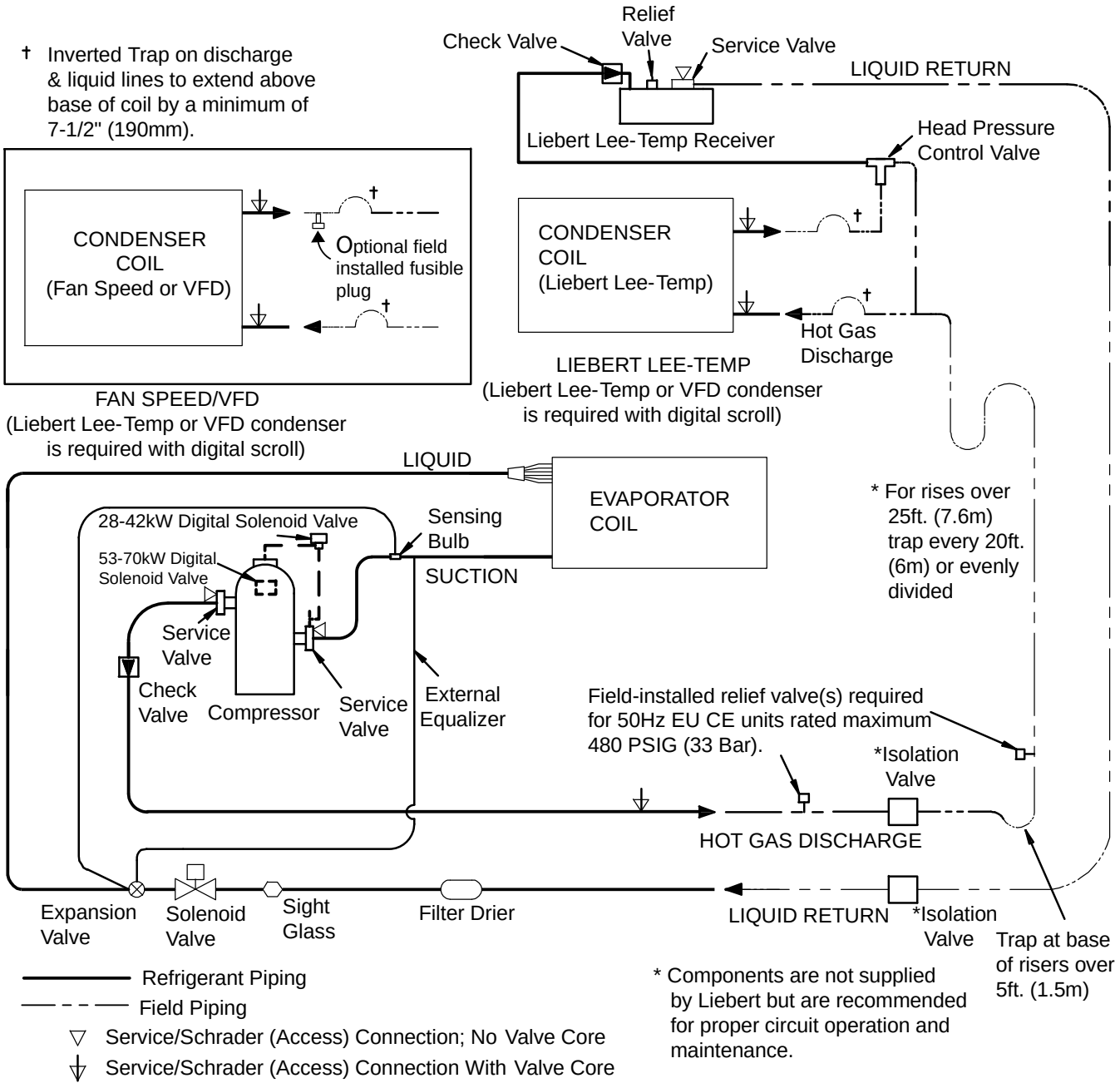
A Surge Protection Device (SPD) panel is standard in the VFD Condenser models only. Surge protection is necessary because the rooftop voltage supply often is not conditioned the same as the voltage supply inside the data center. The SPD is designed to protect the VFD from high voltage transients, up to 25kVA/phase.

An illuminated green LED indicates power supply is On and panel status is OK. An illuminated red LED indicates conditions require service and the SPD may require replacement to restore surge protection to the condenser.

1.5 Typical System Configurations

Figure 3 shows a single refrigeration circuit diagram, displaying the indoor air conditioning unit, the outdoor condenser (VFD, Fan Speed Control or Liebert Lee-Temp) and field-supplied interconnection piping.

Figure 3 Typical system configuration—indoor unit and outdoor condenser and field piping


† Inverted Trap on discharge & liquid lines to extend above base of coil by a minimum of 7-1/2" (190mm).
Relief Valve
Check Valve
Service Valve
LIQUID RETURN
Liebert Lee-Temp Receiver
Head Pressure Control Valve
CONDENSER COIL (Fan Speed or VFD)
Optional field installed fusible plug
CONDENSER COIL (Liebert Lee-Temp)
Hot Gas Discharge
FAN SPEED/VFD (Liebert Lee-Temp or VFD condenser is required with digital scroll)
LIEBERT LEE-TEMP (Liebert Lee-Temp or VFD condenser is required with digital scroll)
LIQUID
EVAPORATOR COIL
* For rises over 25ft. (7.6m) trap every 20ft. (6m) or evenly divided
28-42kW Digital Solenoid Valve
53-70kW Digital Solenoid Valve
Sensing Bulb
SUCTION
Service Valve
Check Valve
Compressor
Service Valve
External Equalizer
Field-installed relief valve(s) required for 50Hz EU CE units rated maximum 480 PSIG (33 Bar).
*Isolation Valve
HOT GAS DISCHARGE
Expansion Valve
Solenoid Valve
Sight Glass
Filter Drier
LIQUID RETURN
*Isolation Valve
Trap at base of risers over 5ft. (1.5m)
Refrigerant Piping
Field Piping
Service/Schrader (Access) Connection; No Valve Core
Service/Schrader (Access) Connection With Valve Core
* Components are not supplied by Liebert but are recommended for proper circuit operation and maintenance.

NOTES: Schematic representation shown. Do not use for specific connection locations. Two refrigeration circuits provided. Single refrigeration circuit shown for clarit y.

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2.0 SITE PREPARATION

2.1 Site Considerations

The condensers should be installed in a location offering maximum security and access for maintenance.

Avoid ground-level sites with public access and areas that contribute to heavy snow or ice accumulations. Utilize Piggyback condensers whenever interior building locations must be used. To ensure adequate air supply, Emerson recommends that condensers be installed in an area with clean air, away from loose dirt and foreign matter that might clog the coil. In addition, condensers should not be located near steam, hot air or fume exhausts. Also, the condensers should be located no closer than 3 feet (1m) from a wall, obstruction or adjacent unit.

The condenser must not be installed in a pit.

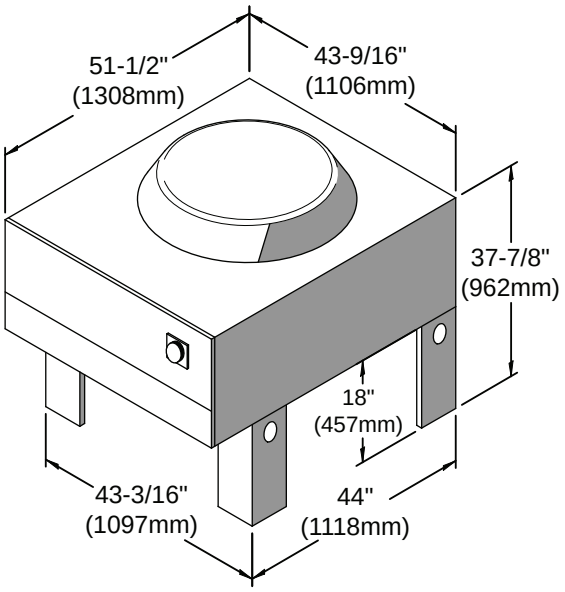
The condenser must be installed on a level surface to ensure proper refrigerant flow. For roof installation, mount the condenser on suitable curbs or other supports in accordance with local codes. Use caution when installing condensers below the indoor unit. Fan Speed and VFD condensers must not be installed more than 15ft. (4.6m) below the indoor unit; Liebert Lee-Temp condensers should be installed above or at the same level as the indoor unit. Contact the factory for assistance in specifying subcooling coils to each circuit to extend these limits.

2.2 Dimensions and Weights

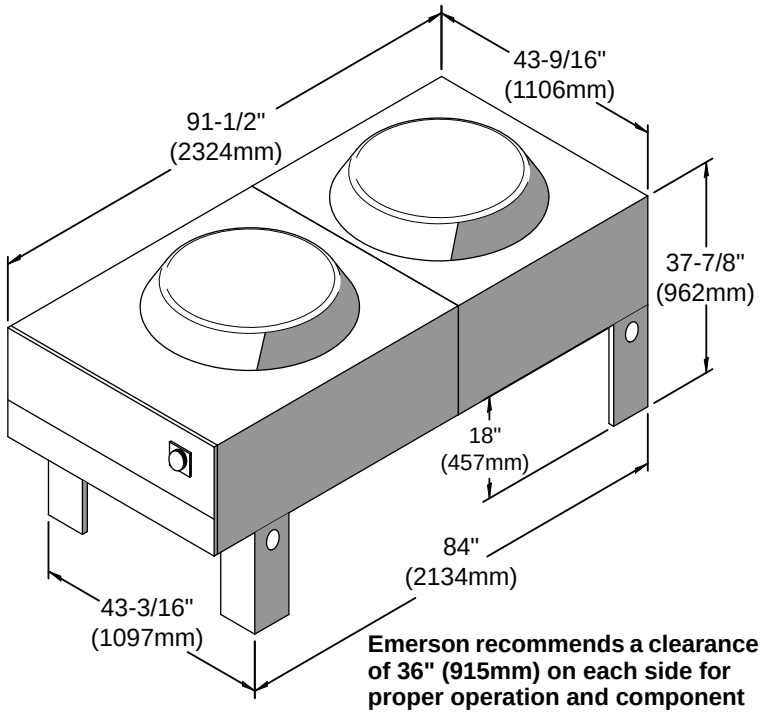
Table 1 Condenser shipping weights, dimensions and volume, approximate

Model	Number of Fans	Domestic Packaging			Export Packaging		
		Weight lb. (kg)	Dimensions (LxWxH) in. (mm)	Volume ft^3 (m^3)	Weight lb. (kg)	Dimensions (LxWxH) in. (mm)	Volume ft^3 (m^3)
083	1	330 (150)	59x30x51 (1500x760x1300)	52 (1.5)	415 (188)	60x31x52 (1520x790x1320)	56 (1.6)
104	1	350 (159)			435 (197)		
28K	1	350 (159)			435 (197)		
063	1	350 (159)			435 (197)		
165	2	490 (222)	97x30x51 (2460x760x1300)	86 (2.4)	690 (313)	98x31x52 (2490x790x1320)	91 (2.6)
205	2	560 (254)			760 (345)		
60K	2	560 (254)			760 (345)		
119	2	490 (222)			690 (313)		
127	2	560 (254)			760 (345)		
143	2	655 (297)			855 (388)		
251	3	590 (268)	139x30x51 (3530x760x1300)	123 (3.5)	870 (395)	140x31x52 (3560x790x1320)	131 (3.7)
308	3	760 (345)			1040 (472)		
90K	3	760 (345)			1040 (472)		
214	3	885 (401)			1165 (528)		
415	4	935 (424)	179x30x51 (4550x760x1300)	158 (4.5)	1235 (560)	180x31x52 (4570x790x1320)	168 (4.8)
510	4	1230 (558)			1530 (694)		
286	4	1185 (537)			1485 (674)		
616	6	1560 (708)	144x36x97 (3660x910x2460)	291 (8.2)	2010 (912)	145x37x97 (3680x940x2460)	301 (8.5)
409	6	1620 (735)			2070 (939)		
830	8	1930 (875)	184x36x97 (4670x910x2460)	372 (10.5)	2430 (1102)	185x37x97 (4700x940x2460)	384 (10.9)
1010	8	2910 (1321)			3410 (1548)		
572	8	2575 (1168)			3075 (1395)		

Figure 4 Condenser planning dimensional data—One-fan and two-fan units

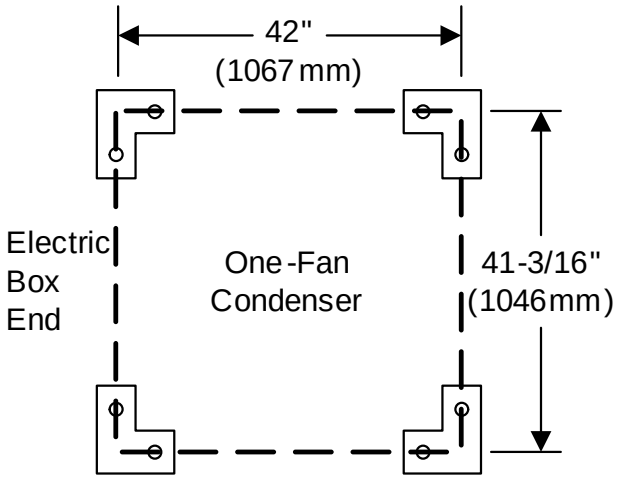


Note:
Overall height to the top of fan guard
43-1/8" (1095mm)



Emerson recommends a clearance of 36" (915mm) on each side for proper operation and component access.

ANCHOR PLAN



See Figure 7 for typical condenser footprint dimensions.

ANCHOR PLAN

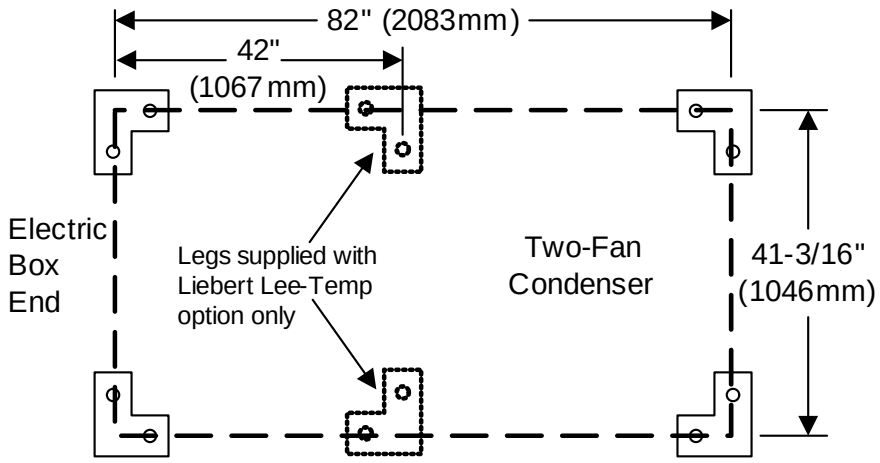
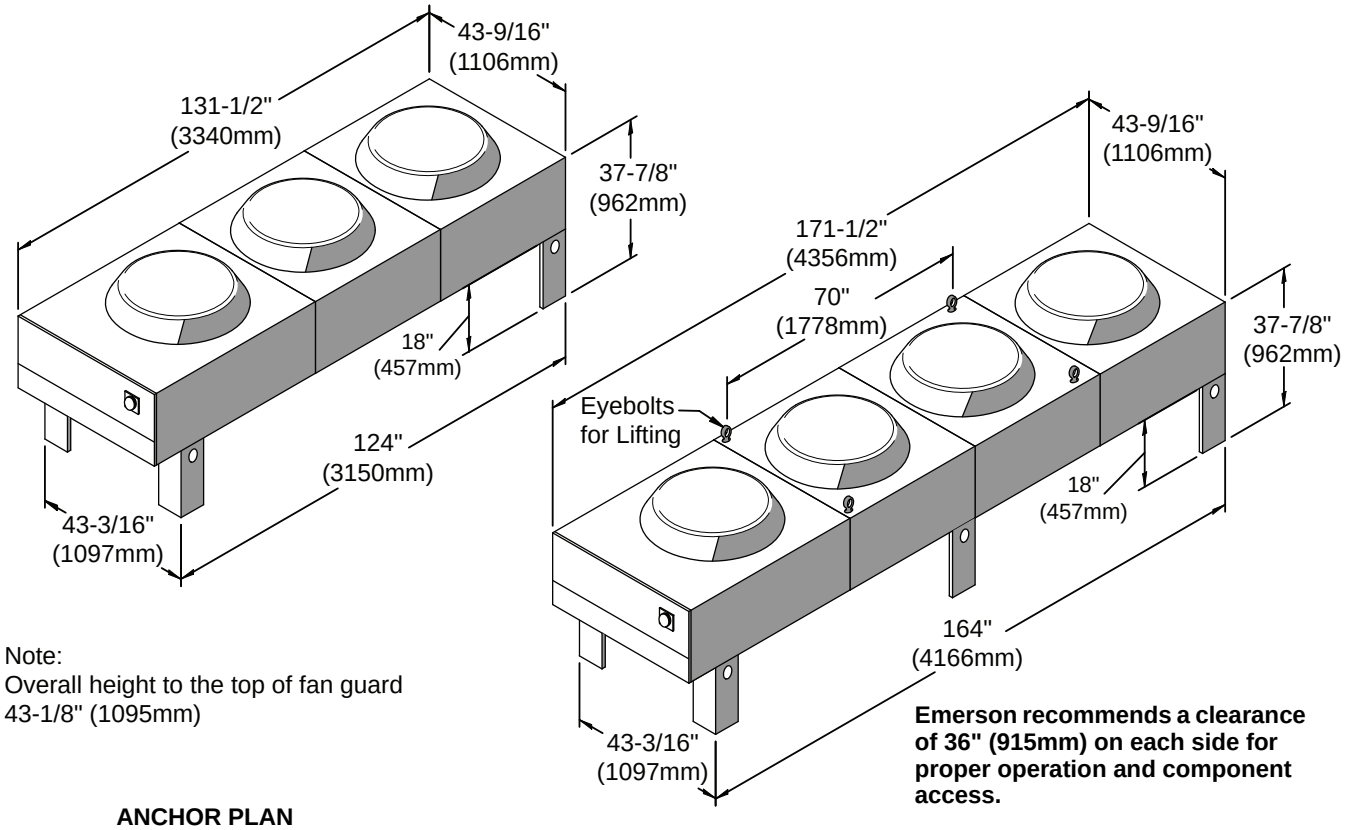
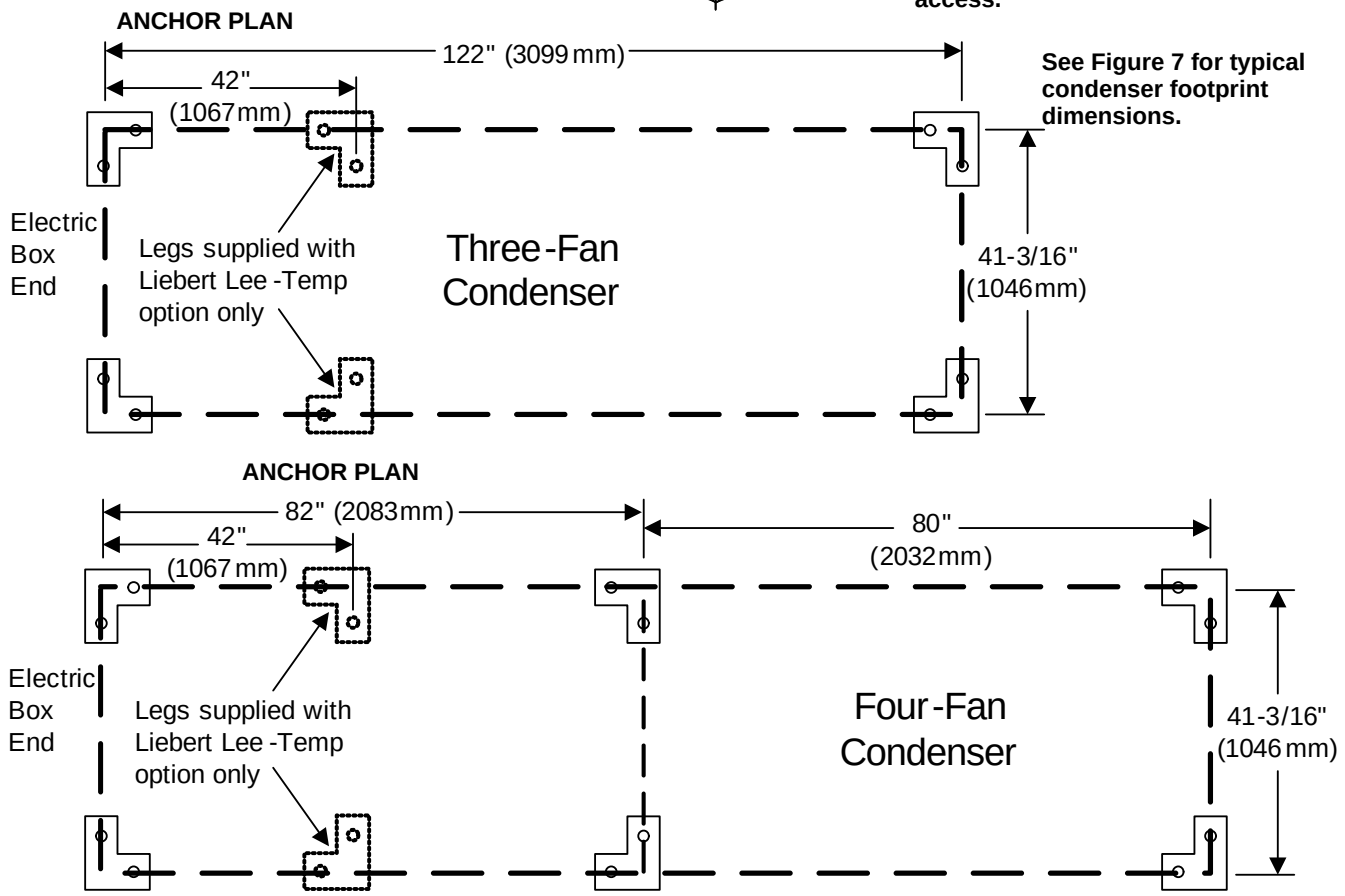


Figure 5 Condenser planning dimensional data—Three-fan and four-fan units



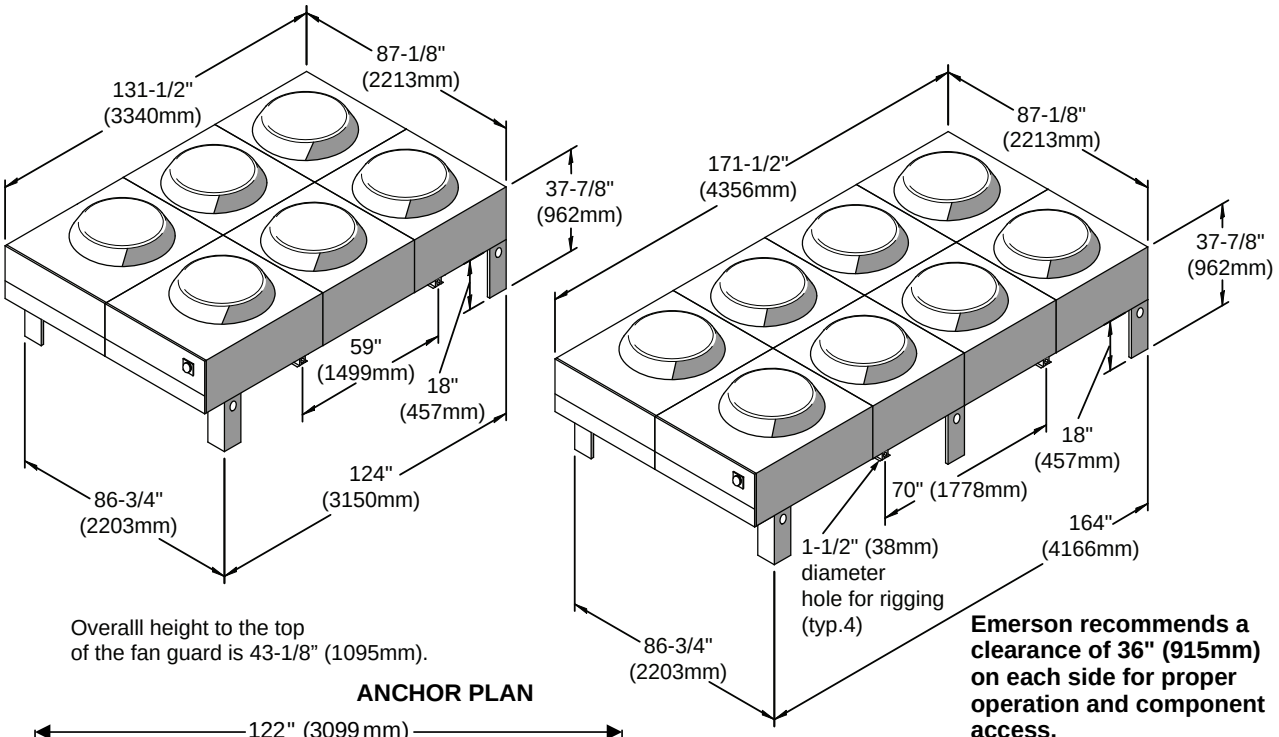
Note:
Overall height to the top of fan guard 43-1/8" (1095mm)

Emerson recommends a clearance of 36" (915mm) on each side for proper operation and component access.



See Figure 7 for typical condenser footprint dimensions.

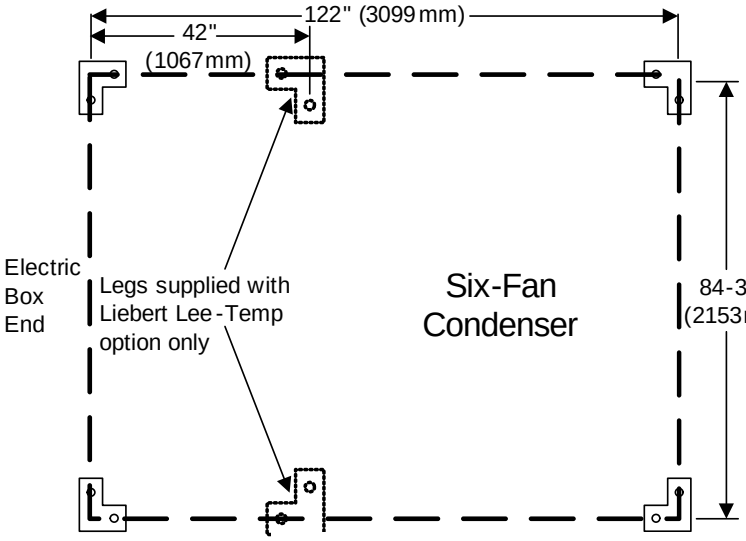
Figure 6 Condenser planning dimensional data—Six- and eight-fan units



Overalll height to the top
of the fan guard is 43-1/8" (1095mm).

Emerson recommends a clearance of 36" (915mm) on each side for proper operation and component access.

ANCHOR PLAN



See Figure 7 for typical condenser footprint dimensions.

ANCHOR PLAN

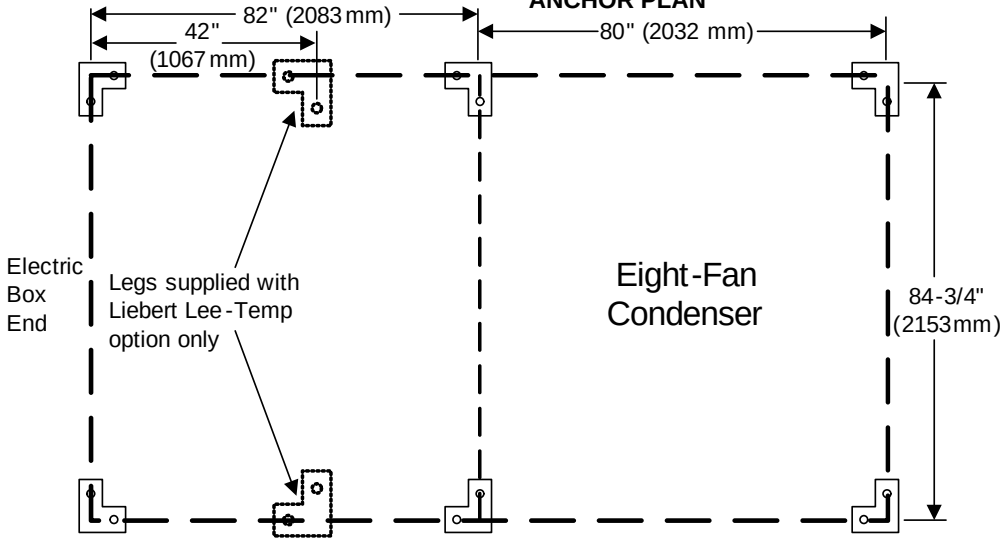


Figure 7 Typical condenser footprint—dimensions

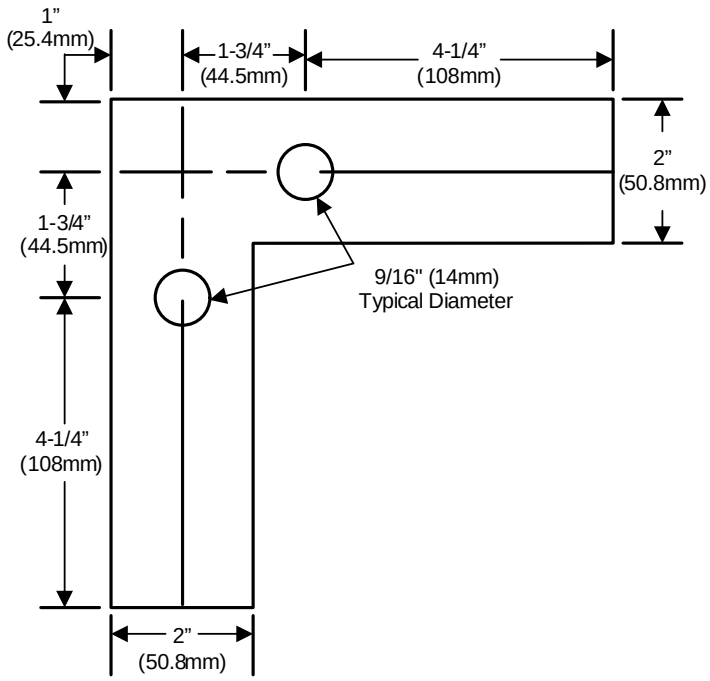


Figure 8 Piping connection locations for 1-, 2-, 3- and 4-fan VFD Control and Fan Speed Condensers

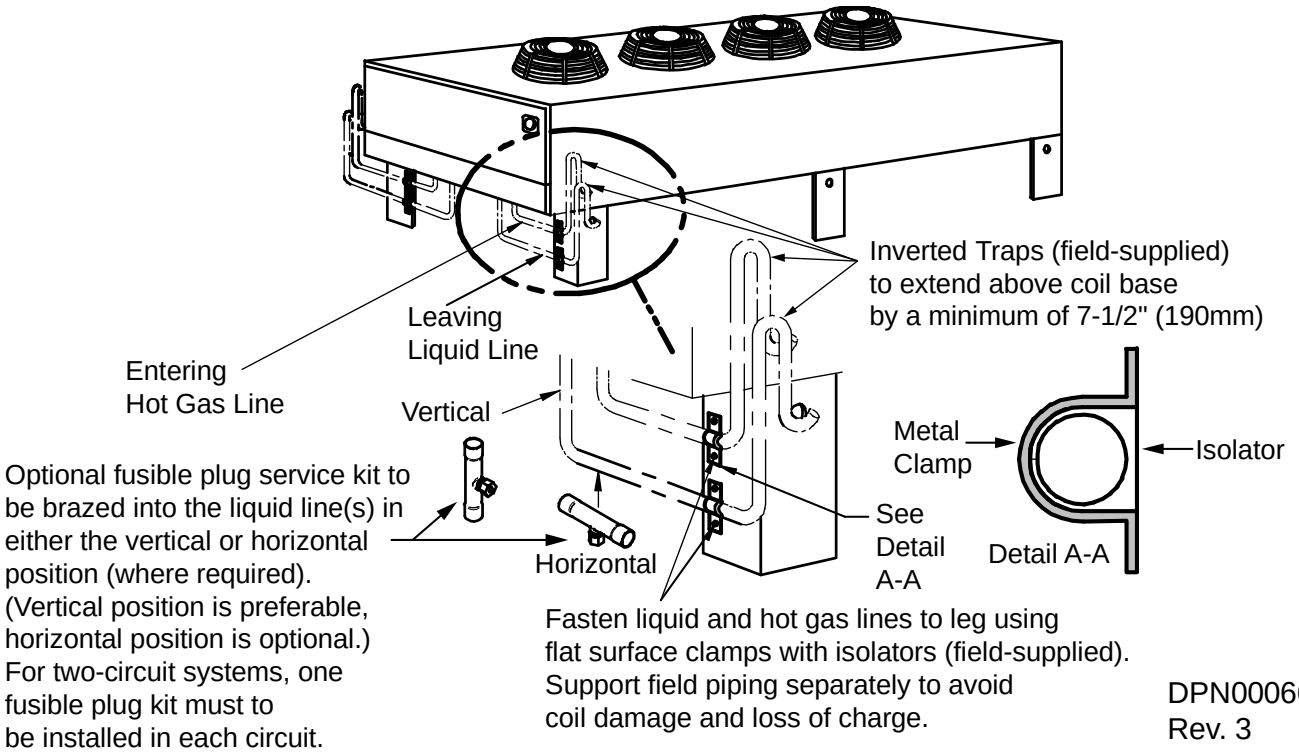


Figure 9 Piping connections for 1-, 2-, 3- and 4-fan Liebert Lee-Temp and Liebert Quiet-Line Condensers

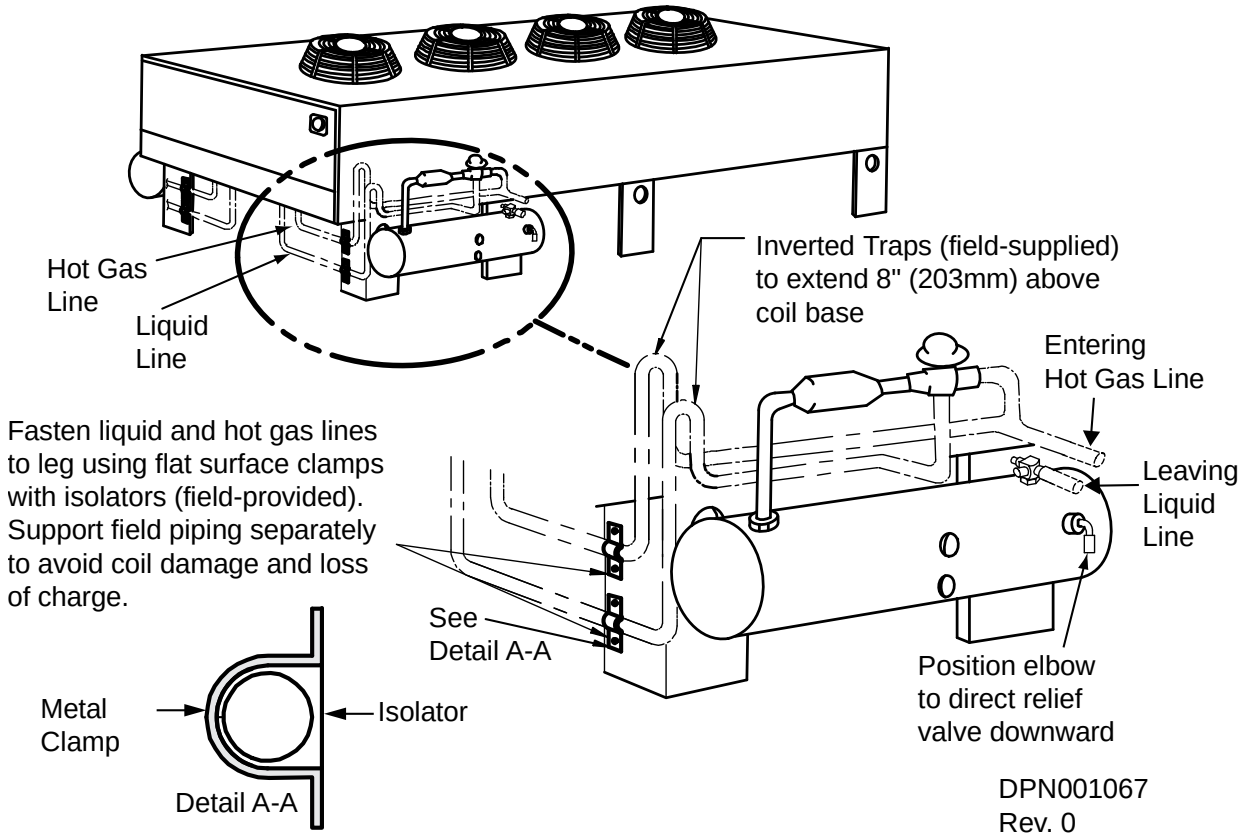

Hot Gas Line
Liquid Line
Inverted Traps (field-supplied) to extend 8" (203mm) above coil base
Entering Hot Gas Line
Leaving Liquid Line
Fasten liquid and hot gas lines to leg using flat surface clamps with isolators (field-provided). Support field piping separately to avoid coil damage and loss of charge.
See Detail A-A
Position elbow to direct relief valve downward
Metal Clamp
Isolator
Detail A-A
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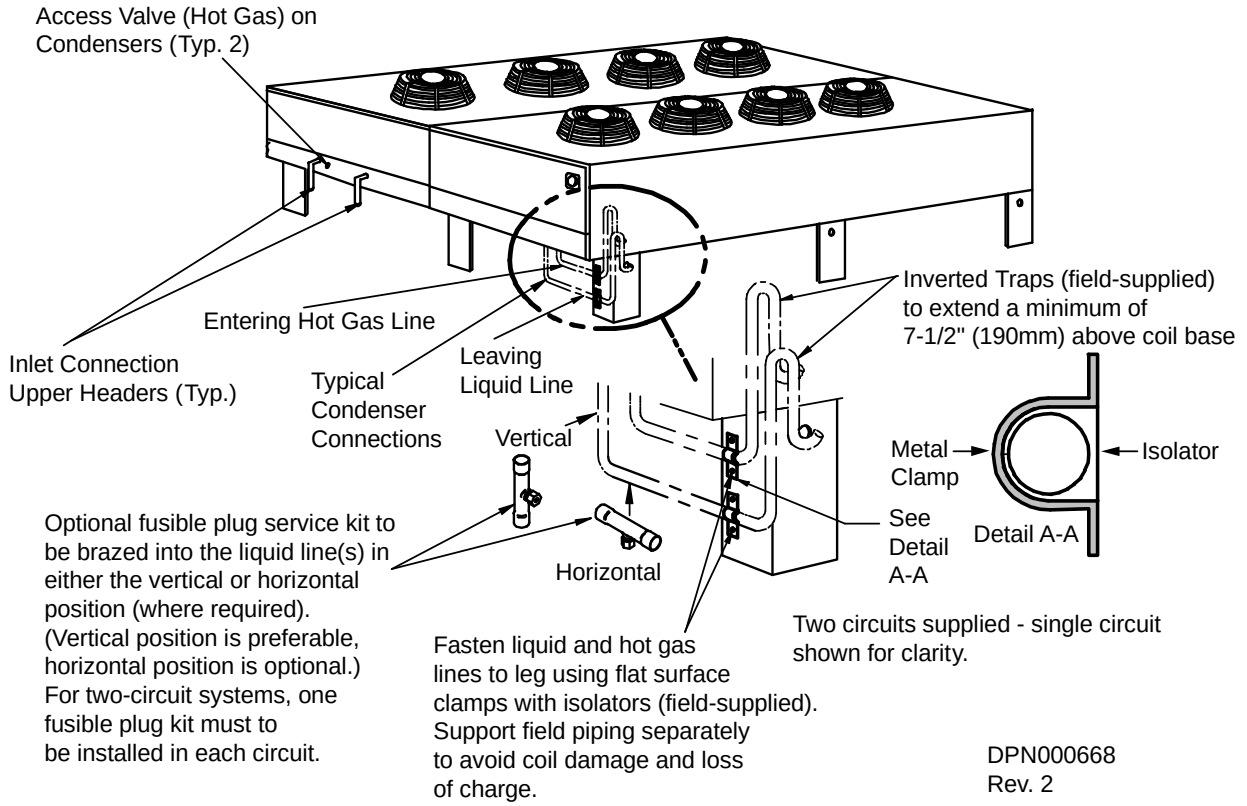
Figure 10 Piping connections for 6- and 8-fan Fan Speed Condensers


Access Valve (Hot Gas) on Condensers (Typ. 2)
Inverted Traps (field-supplied) to extend a minimum of 7-1/2" (190mm) above coil base
Entering Hot Gas Line
Inlet Connection Upper Headers (Typ.)
Typical Condenser Connections
Leaving Liquid Line
Vertical
Metal Clamp
Isolator
See Detail A-A
Detail A-A
Optional fusible plug service kit to be brazed into the liquid line(s) in either the vertical or horizontal position (where required). (Vertical position is preferable, horizontal position is optional.) For two-circuit systems, one fusible plug kit must to be installed in each circuit.
Horizontal
Two circuits supplied - single circuit shown for clarity.
Fasten liquid and hot gas lines to leg using flat surface clamps with isolators (field-supplied). Support field piping separately to avoid coil damage and loss of charge.
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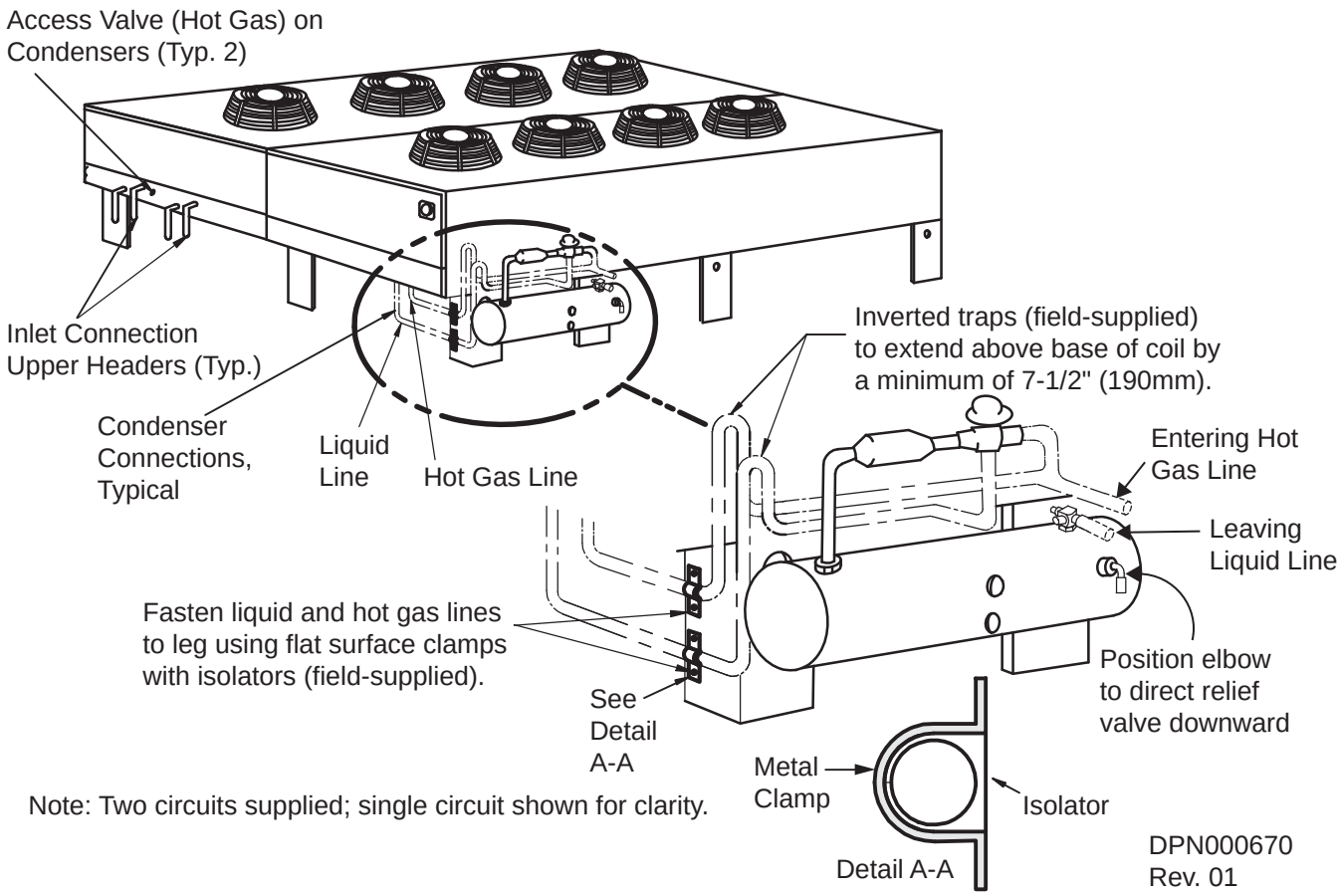
Rev. 2

Figure 11 Piping connections for 6- and 8-fan Liebert Lee-Temp and Liebert Quiet-Line Condensers


Access Valve (Hot Gas) on Condensers (Typ. 2)
Inlet Connection Upper Headers (Typ.)
Condenser Connections, Typical
Liquid Line
Hot Gas Line
Inverted traps (field-supplied) to extend above base of coil by a minimum of 7-1/2" (190mm).
Entering Hot Gas Line
Leaving Liquid Line
Fasten liquid and hot gas lines to leg using flat surface clamps with isolators (field-supplied).
See Detail A-A
Position elbow to direct relief valve downward
Metal Clamp
Isolator
Detail A-A
DPN000670 Rev. 01

Note: Two circuits supplied; single circuit shown for clarity.

Table 2 Condenser physical data

Model #	Number of Fans	Number of Circuits	Connection Size, OD, In.		Net Weight lb. (kg)
			Hot Gas	Liquid	
Standard Models					
083	1	1	7/8	5/8	295 (134)
104	1	1	1-1/8	5/8	315 (143)
104	1	2	7/8	1/2	315 (143)
165	2	1	1-1/8	7/8	425 (193)
165	2	2	7/8	5/8	425 (193)
205	2	1	1-1/8	7/8	495 (225)
205	2	2	1-1/8	7/8	495 (225)
251	3	1	1-1/8	7/8	500 (227)
251	3	2	1-1/8	7/8	500 (227)
308	3	1	1-5/8	1-1/8	670 (304)
308	3	2	1-3/8	1-1/8	670 (304)
415	4	1	1-3/8	1-1/8	840 (381)
415	4	2	1-3/8	1-1/8	840 (381)
510	4	1	2-1/8	1-5/8	1190 (540)
510	4	2	1-5/8	1-1/8	1190 (540)
616 [1]	6	1	(2) 1-5/8	(2) 1-1/8	1380 (626)
616	6	2	1-5/8	1-1/8	1380 (626)
830	8	2	1-3/8	1-1/8	1750 (794)
1010	8	2	2-1/8	1-5/8	2640 (1197)
Liebert Quiet-Line Models					
063	1	1	1-1/8	5/8	315 (143)
119	2	1	1-1/8	7/8	425 (193)
119	2	2	7/8	5/8	425 (193)
127	2	1	1-1/8	7/8	495 (225)
127	2	2	1-1/8	7/8	495 (225)
143	2	1	1-1/8	7/8	515 (234)
143	2	2	1-1/8	7/8	515 (234)
214	3	1	1-5/8	1-1/8	840 (381)
214	3	2	1-1/8	7/8	840 (381)
286	4	1	2-1/8	1-1/8	1105 (501)
286	4	2	1-1/8	7/8	1105 (501)
409	6	2	1-5/8	1-1/8	1380 (626)
572	8	2	2-1/8	1-1/8	2430 (1102)
R-410A Models					
28K	1	1	1-1/8	7/8	325 (147)
60K	2	1	1-1/8	7/8	475 (215)
90K	3	1	1-1/8	7/8	675 (306)

1. Interconnection piping (field-supplied and installed) required. Configure piping for parallel refrigerant flow between condenser sections.

Table 3 Liebert Lee-Temp receiver weights and cross-reference to condenser

Condenser Model #	Receiver Part #	Receivers per Condenser	Weight per Receiver lb. (kg)
Standard Models			
DCSL083	1C19982P1	1	100 (45)
DCSL104	1C19982P1		100 (45)
DCSL165	W-0050		125 (57)
DCSL205	W-0050		125 (57)
DCSL251	W-0050		125 (57)
DCSL308	W-0060		145 (66)
DCSL415	185011P1		260 (118)
DCSL616	W-0410 [1]		200 (91)
DCSL616	179701P1 [2]		424 (192)
DCDL104	1C19982P1	2	100 (45)
DCDL165	1C19982P1		100 (45)
DCDL205	W-0050		125 (57)
DCDL251	1C19982P1		100 (45)
DCDL308	W-0050		125 (57)
DCDL415	W-0060		145 (66)
DCDL510	W-0410		200 (91)
DCDL616	W-0060		145 (66)
DCDL830	185011P1		260 (118)
Liebert Quiet-Line Models			
DCSL063	1C19982P1	1	100 (45)
DCST119	W-0050		125 (57)
DCSL127	W-0050		125 (57)
DCSL143	W-0060		145 (66)
DCST214	W-0410		200 (91)
DCST286	W-0410		200 (91)
DCDL119	1C19982P1	2	100 (45)
DCDL127	1C19982P1		100 (45)
DCDL143	W-0050		125 (57)
DCDT214	W-0050		125 (57)
DCDL286	W-0060		145 (66)
DCDT409	W-0410		200 (91)
DCDT572	W-0410		200 (91)
R-410A Models			
DCSL28K	195315P1	1	125 (57)
DCSL60K	195316P1		145 (66)
DCSL90K	196702P1		200 (91)

1. Matchup for 35 to 105°F (2 to 41°C) design temperature range.
2. Matchup for -30 to 105°F (-34 to 41°C) design temperature range.

2.3 Refrigerant Planning Values

Planning for the refrigerant requirements of the completed system is the addition of the charges from Indoor Unit, Condenser (including Liebert Lee-Temp receiver, if used) and the interconnecting piping. **Tables 4** and **7** provide the approximate charge required for the condensers and the interconnecting piping. Consult indoor unit manuals for indoor unit charge requirements.

These values can be used for obtaining adequate refrigerant for the system, but should not be used for final charging. Consult indoor unit manual for charging procedures.

Table 4 R-22 and R-407C refrigerant required, approximate

Standard Condenser Models	Approximate R-22 Refrigerant Needed				Approximate R-407C Refrigerant Needed			
	Single Circuit lb. (kg)		Dual Circuit lb./circuit (kg/circuit)		Single Circuit lb. (kg)		Dual Circuit lb./circuit (kg/circuit)	
	FSC or VFD	Lee-Temp (includes receiver)	FSC or VFD	Lee-Temp (includes receiver)	FSC or VFD	Lee-Temp (includes receiver)	FSC or VFD	Lee-Temp (includes receiver)
083	5 (2.3)	27 (12.3)	3 (1.4)	N/A	5 (2.3)	26 (11.8)	3 (1.4)	N/A
104	8 (3.6)	39 (17.7)	7 (3.2)	21 (9.5)	8 (3.6)	37 (16.8)	7 (3.2)	20 (9.0)
165	15 (6.8)	53 (24.0)	5 (2.3)	27 (12.3)	15 (6.8)	50 (22.7)	5 (2.3)	26 (11.8)
205	20 (9.1)	76 (34.5)	7 (3.2)	56 (25.3)	19 (8.6)	72 (32.7)	7 (3.2)	54 (24.4)
251	19 (8.6)	75 (34.0)	10 (4.6)	38 (17.2)	18 (8.2)	71 (32.2)	10 (4.6)	36 (16.3)
308	29 (13.2)	113 (51.3)	11 (5.0)	58 (26.3)	28 (12.7)	107 (48.5)	11 (5.0)	55 (24.9)
415	54 (24.5)	210 (95.0)	25 (11.3)	107 (48.4)	51 (23.1)	200 (90.8)	24 (10.9)	102 (46.2)
510	72 (32.7)	N/A	30 (13.6)	149 (67.6)	68 (30.8)	N/A	29 (13.2)	142 (64.4)
616	N/A	N/A	27 (12.3)	113 (51.3)	N/A	See **Table 5**	26 (11.8)	108 (49.0)
830	N/A	N/A	53 (24)	210 (95.1)	N/A	N/A	51 (23.1)	200 (90.8)
1010	N/A	N/A	60 (27.2)	154 (69.9)	N/A	N/A	57 (25.9)	147 (66.7)
Liebert Quiet-Line Condenser Models								
063	N/A	39 (17.7)	N/A	N/A	N/A	37 (16.8)	N/A	N/A
119	N/A	50 (22.7)	N/A	27 (12.3)	N/A	48 (21.8)	N/A	26 (11.8)
127	N/A	76 (34.5)	N/A	38 (17.2)	N/A	72 (32.6)	N/A	36 (16.3)
143	N/A	126 (57.2)	N/A	64 (29.0)	N/A	120 (54.5)	N/A	61 (27.7)
214	N/A	161 (73.0)	N/A	81 (36.7)	N/A	153 (69.4)	N/A	77 (34.9)
286	N/A	196 (88.9)	N/A	125 (56.7)	N/A	186 (84.4)	N/A	119 (54.0)
409	N/A	N/A	N/A	152 (68.9)	N/A	N/A	N/A	148 (67.2)
572	N/A	N/A	N/A	196 (88.9)	N/A	N/A	N/A	186 (84.4)

Table 5 R-407C refrigerant required for DCSL616 condensers for Liebert XDC, approximate

Model #	Liebert Lee-Temp Receiver	Receiver Tank Length, in. (mm)	Refrigerant Per Circuit (inc. receiver), lb. (kg)
DCSL616	W-0410	48 (1219)	164 (75)
	179701P1	96 (2438)	254 (115.2)

Table 6 R-410A refrigerant required, approximate

Single Circuit Model	VFD lb. (kg)	Liebert Lee-Temp (inc. receiver) lb. (kg)
28K	7 (3.2)	41 (18.6)
60K	16 (7.3)	75 (34.0)
90K	25 (11.3)	109 (49.4)

Table 7 Interconnecting piping refrigerant charge

Line Size, O.D., in.	R-22, lb./100 ft. (kg/30m)		R-407C, lb./100 ft. (kg/30m)		R-410A, lb./100 ft. (kg/30m)	
	Liquid Line	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line	Hot Gas Line
3/8	3.8 (1.7)	—	3.7 (1.7)	—	—	—
1/2	7.3 (3.3)	—	6.9 (3.1)	—	5.0 (2.1)	—
5/8	11.7 (5.3)	2.1 (1.0)	11.0 (5.0	2.2 (1.0)	10.0 (4.2)	1.1 (0.51)
3/4	16.6 (7.5)	3.0 (1.4)	15.7 (7.1)	3.1 (1.3)	13.0 (5.7)	1.5 (0.67)
7/8	24.4 (11.1)	4.4 (2.0)	23.0 (10.4)	4.5 (1.9)	—	2.3 (1.0)
1-1/8	41.4 (18.9)	7.8 (3.5)	39.3 (17.8)	7.8 (3.5)	—	3.9 (1.8)
1-3/8	63.3 (28.7)	11.8 (5.4)	59.8 (27.1	11.8 (5.4)	—	—
1-5/8	—	16.7 (7.6)	—	16.7 (7.6)	—	—

3.0 INSPECTION AND INSTALLATION

3.1 Equipment Inspection

Before unpacking the condenser, verify that the labeled equipment matches the bill of lading. Carefully inspect all items for damage, either visible or concealed. Report any damage immediately to the carrier and your local Emerson representative. File a damage claim with the carrier and send a copy to your local Emerson representative.

3.1.1 Packing Material

All material used to package this unit is recyclable. Please save it for future use or dispose of the material appropriately.

SAFETY INFORMATION

WARNING

Risk of improper handling. Can cause equipment damage, injury or death.

Read all of the following instructions before attempting to move, lift, remove packaging from or preparing unit for installation.

CAUTION

Risk of sharp edges, splinters and exposed fasteners. Can cause personal injury.

Only properly trained and qualified personnel wearing appropriate safety headgear, gloves, shoes and glasses should attempt to move, lift, remove packaging from or prepare unit for installation.

NOTICE

Risk of overhead interference. Can cause unit and/or structure damage.

Refer to the installation plans prior to moving the unit to verify clearances.

NOTICE

Risk of improper forklift handling. Can cause unit damage.

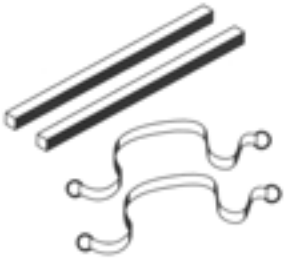
Keep tines of the forklift level and at a height suitable to fit under the skid.

NOTICE

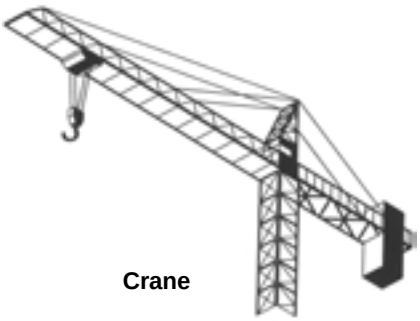
Risk of improper storage. Can cause unit damage. Keep unit upright and protected from contact damage.

Figure 12 Equipment recommended for handling a Liebert condenser

Forklift



Lift Beam, Slings and Spreader Bars



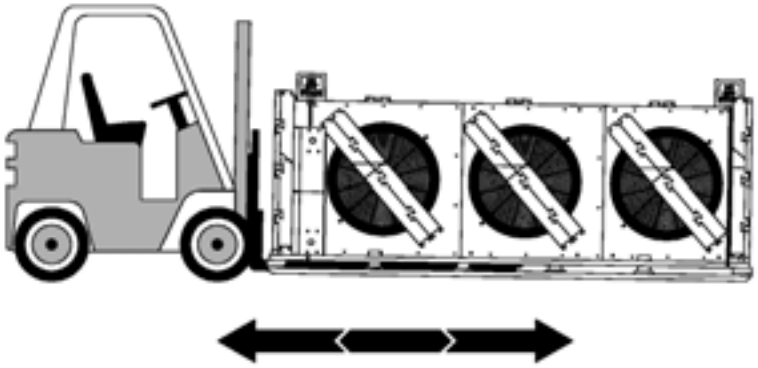
Crane

3.2 Handling Unit on the Skid

Transport the unit using a forklift or a crane with sling and spreader bars.

- If using a forklift, make sure the forks (if adjustable) are spread to the widest allowable distance to still fit under the skid.
- Type of forklift used will be dependant on the terrain the unit is be moved across during handling.
- Minimum forklift fork length:
  - for one-fan and two-fan units—48" (1219mm)
  - for three-fan and four-fan units—72" (1829mm)
  - for six fan units—72" (1829mm)
  - for 8 fan units—96" (2438mm)
- When moving the packaged unit, do not lift the unit any higher than 6" (152mm) off the ground. If the unit must be lifted higher than 6" (152mm), great care must be exercised and all personnel not involved in moving the unit must be at least 20' (5m) from the lift point of the unit.

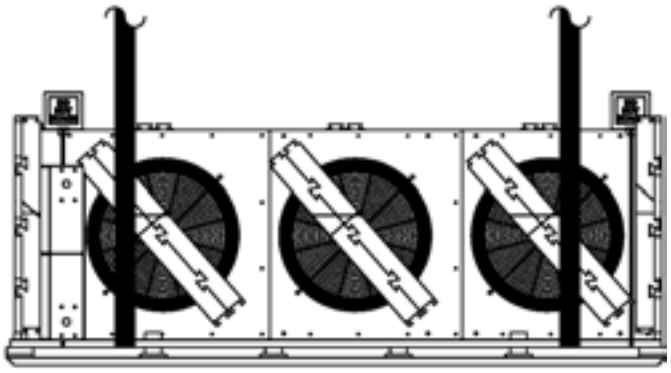
Figure 13 Forklift position with one-fan to eight-fan condensers



Three-fan unit shown. Positioning for other Liebert condensers are the same.

- When using a fork lift to off-load or move for installation, it is recommended to lift one narrow end off the ground no more than 6" (152mm). Use the forklift to push or pull the unit.
- When using a crane to lift the unit from a flat bed or to move for installation, it is recommended using slings rated for the unit weight.
- Spreader bars are to be used for sling stability and to prevent unit pinching. Make sure spreader bars are wider than the unit.
- Slings are to be placed near the ends of the unit, under the top deck boards of the skid.

Figure 14 Lifting condenser off skid



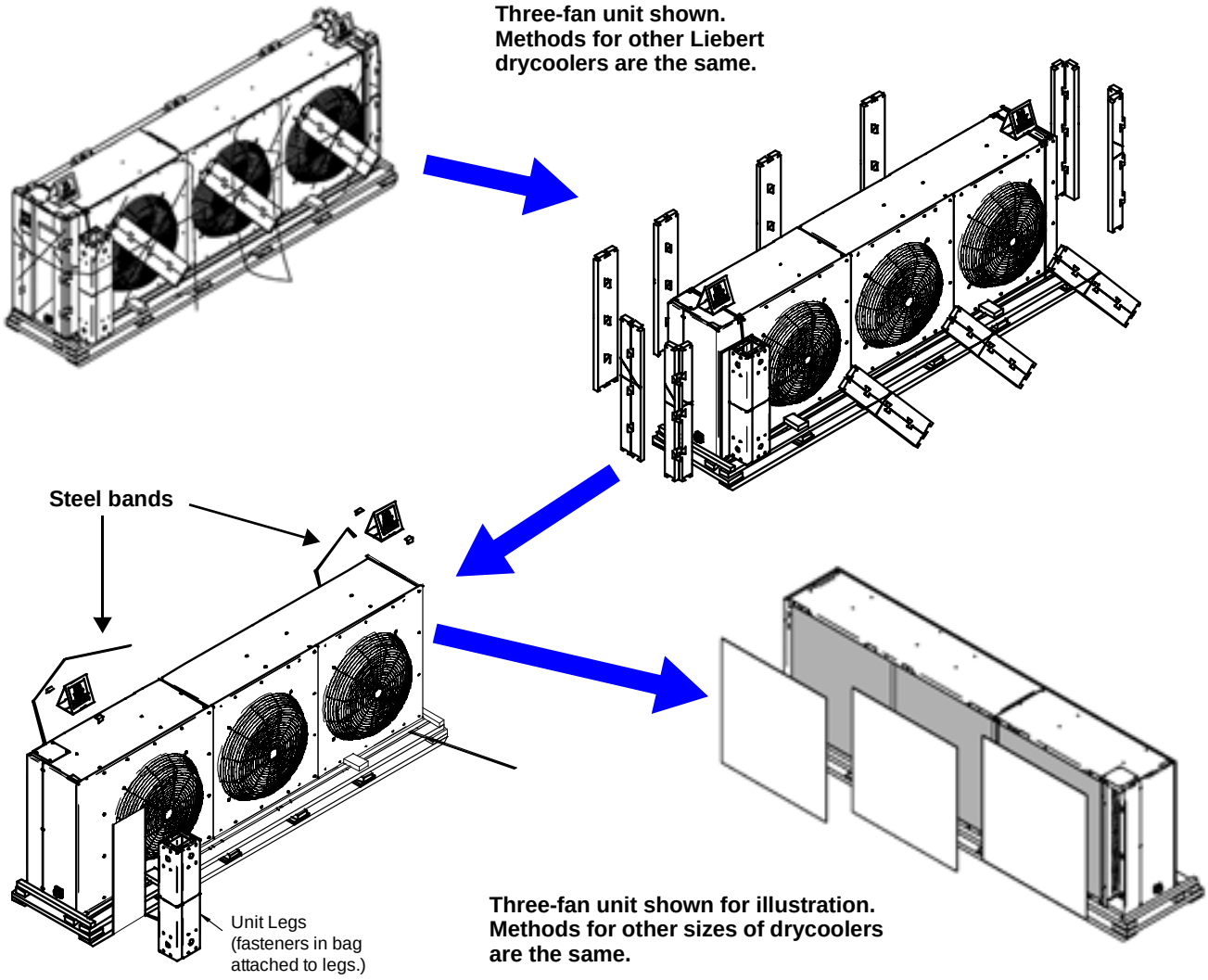
Three-fan unit shown. Positioning for other Liebert condensers are the same.

3.3 Unpacking the Condenser—All Unit Sizes

To unpack a condenser with one to eight fans:

1. Remove the exterior stretch wrap packaging material from around the unit.
2. Remove corner and side foam planks from around the unit.
3. Remove the steel bands holding the unit to the skid.
4. Set unit legs aside, but accessible.
5. Remove corrugated panels covering the coil(s) of the unit.

Figure 15 Removing protective material



3.4 Preparing a Condenser for Moving and Installation—Units with One to Four Fans

The following procedure is one recommended method for removing a Liebert condenser from its shipping skid. Other methods may be used, provided that they are safe for personnel, the condenser and equipment.

3.4.1 Attaching Legs, Removing the Skid and Attaching Slings—Units with One to Four Fans

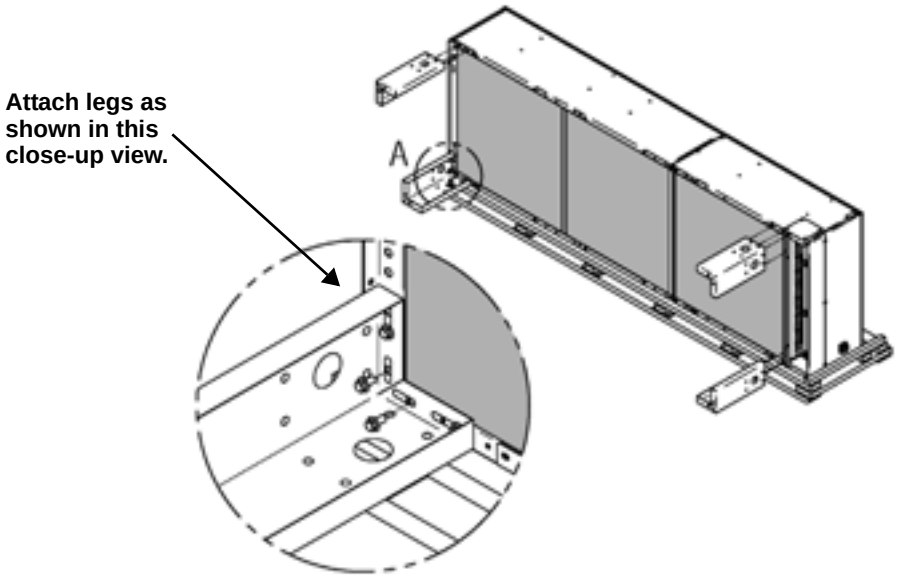
1. Attach legs to the unit at indicated locations.

   Use the fasteners provided with the legs.

   Recommended tools for attachment is a 5/8" socket and ratchet.

   More legs may be available for installation than shown, this will be dependent on unit type and number of fans.

Figure 16 Attaching legs to one-fan to four-fan condensers

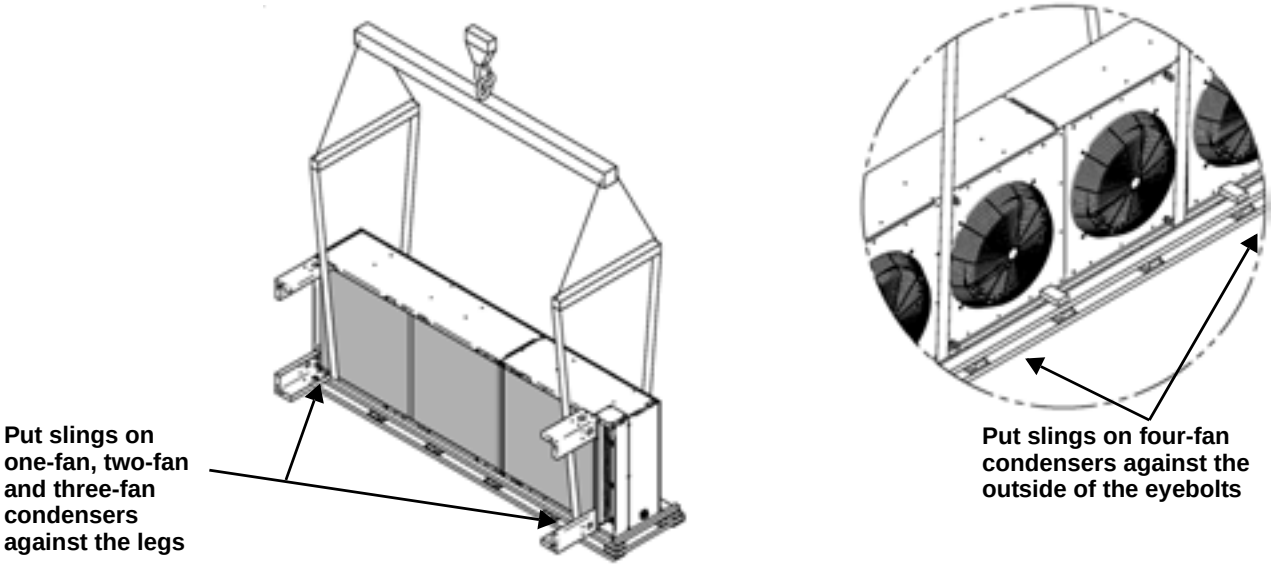


2. Place slings around the unit:
   - **One-, two- and three-fan units**: place slings against the inside of the attached legs.
   - **Four-fan units**: place slings against the outside of the attached eye bolts.

   Slings are to be placed between the unit and the top deck boards of the skid.

   Use spreader bars, lift beam and crane to lift the unit off the skid. Make sure spreader bars wider than the unit.

Figure 17 Securing slings to one-fan to four-fan condensers for lifting off skid


Put slings on one-fan, two-fan and three-fan condensers against the legs
Put slings on four-fan condensers against the outside of the eyebolts

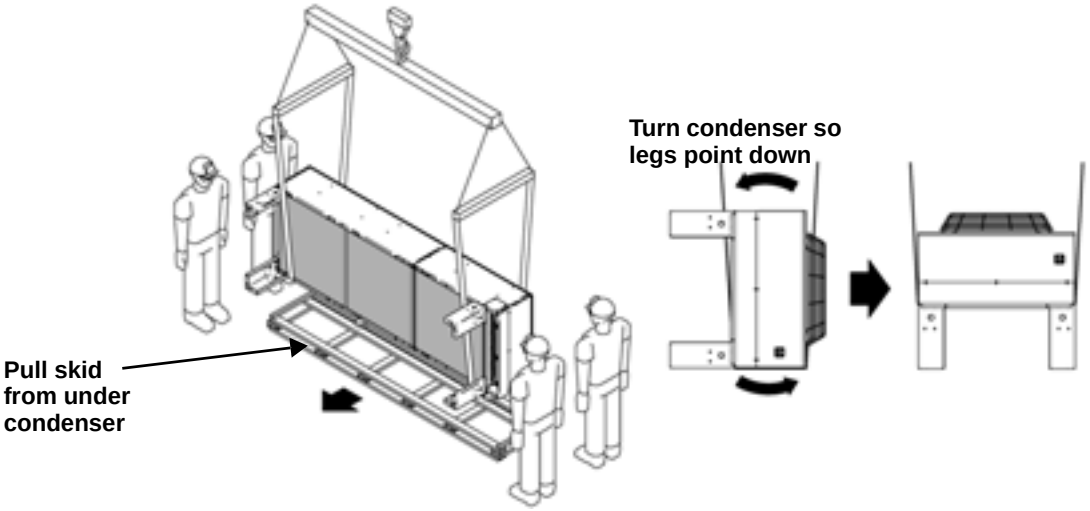
3. Lift the unit 24" (610mm) off the top deck of the skid.

   Remove the skid from under the unit.

   A mechanized method is preferred, but if not available use a minimum of four properly protected individuals to turn the unit upright so that the legs point down.

   Unit legs are to be pointing toward the ground.

Figure 18 Remove skid, set condenser on floor



1. Set the upright unit on the ground so the legs support unit weight.
   Remove the straps from around unit.
   - **One-, two- and three-fan units**: route the straps through the large holes on the side of the legs. Spreader bars are still required. Make sure spreader bars are wider than the unit.
   - **Four-fan units**: use the eye bolts on top of the unit to secure straps or chains.

The unit is now ready to be lifted and moved to its installation location.

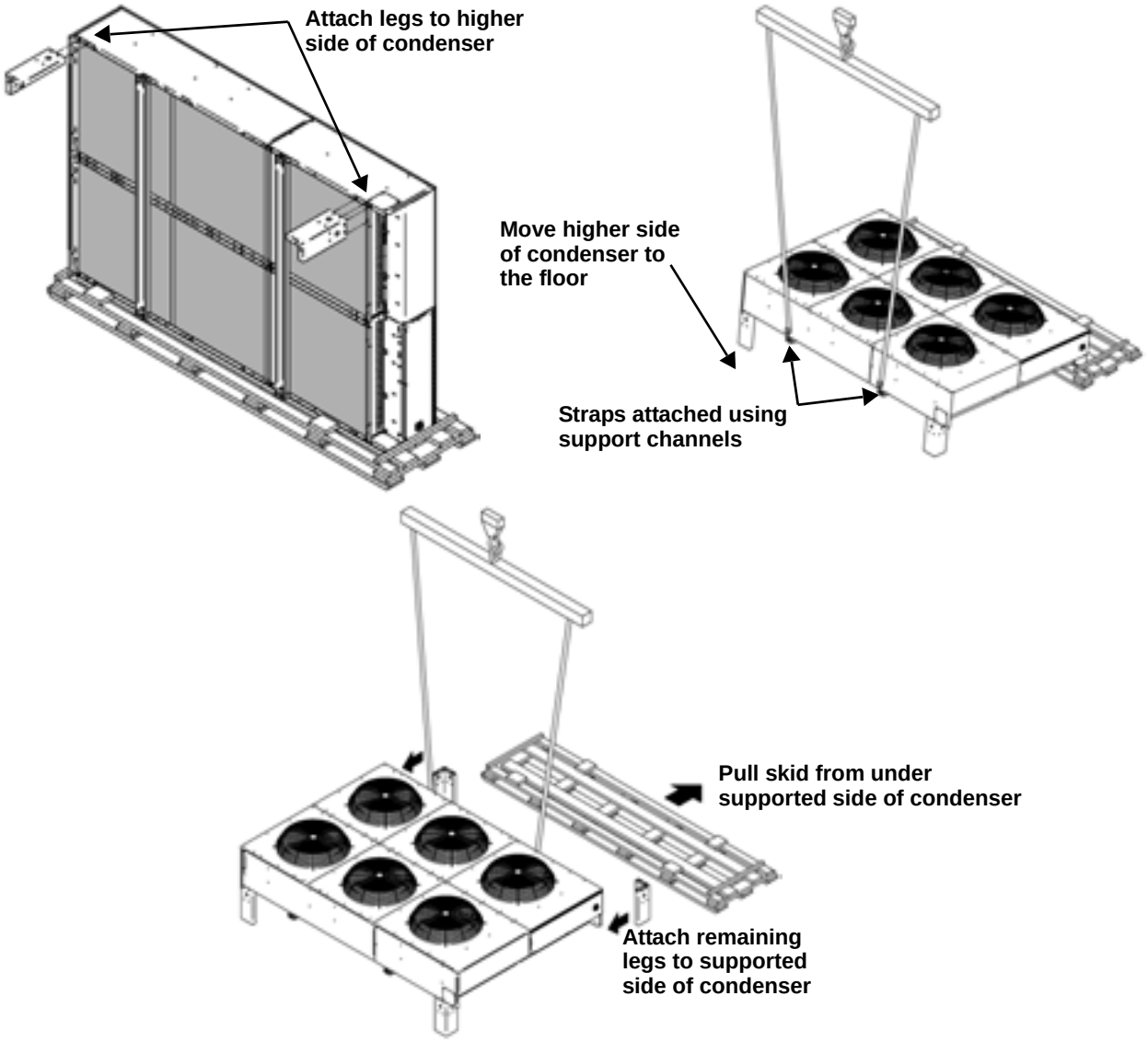
3.5 Preparing a Condenser for Moving and Installation—Units with Six or Eight Fans

The following procedure is one recommended process for removing a Liebert condenser from its shipping skid. Other methods may be used, provided that the methods are safe for personnel, the condenser and equipment.

3.5.1 Attaching Legs, Removing the Skid and Attaching Slings—Units with Six or Eight Fans

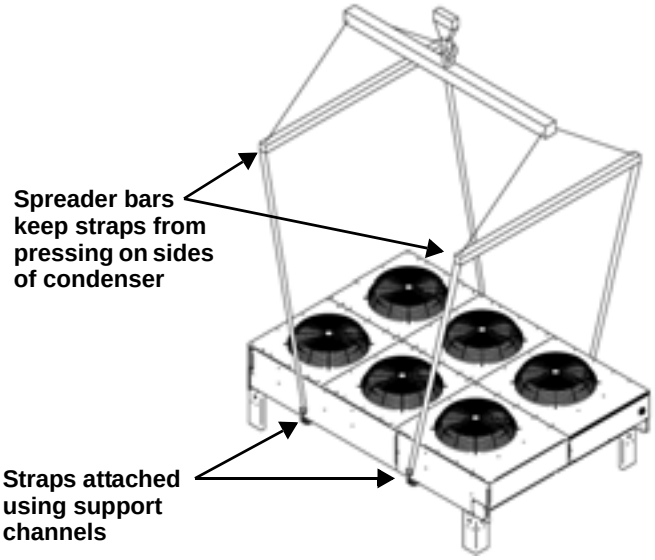
1. Attach upper most legs to the unit at indicated locations.
   Use four (4) fasteners per leg. Fasteners are provided with the legs.
   Quantity of legs per side may vary per unit type and number of fans.
   Recommended tools for attachment is a 5/8" socket and ratchet.
2. Attach slings or chains to the top side of the unit lift rails.
   Mechanically lower the unit in order to rest on the attached legs.
   Make sure not to damage the opposite side of the unit.
3. Move the slings or chains to the lift rail side resting on the skid.
   Mechanically lift the unit to a point where the side being lifted is just high enough to allow for safe attachment of the remaining unit legs.
   Move the skid out the way.
4. Use the support channels located under the unit to attach straps or chains. Spreader bars are still required. Make sure spreader bars are wider than the unit.

Figure 19 Attach legs to six- and eight-fan condensers, remove from skid


Attach legs to higher side of condenser
Move higher side of condenser to the floor
Straps attached using support channels
Pull skid from under supported side of condenser
Attach remaining legs to supported side of condenser

The unit is ready to be lifted and moved to its installation location.

Figure 20 Rigging six-fan or eight-fan condenser for lifting into position



3.6 Mounting the Condenser

The condenser must be installed so that it is level within 1/2" (13mm) to ensure proper refrigerant flow. For roof installation, mount the condenser on suitable curbs or other supports; follow all local and national codes. Secure the legs to the mounting surface using a field-supplied 1/2" (13mm) diameter bolt in each of the two 9/16" (14mm) holes in each leg. See **Figures 4**, **5** and **6** for anchor dimensions.

3.7 Electrical Supply Preparation

Line voltage electrical service is required for all models. Refer to equipment nameplate regarding wire size and circuit protection requirements. Electrical service must conform to national and local electrical codes. Refer to **Figures 24**, **25** and **26** for electrical service entrances into unit. Refer to electrical schematic when making connections.

Each unit is shipped from the factory with all internal unit wiring completed.

WARNING

Risk of electric shock. Can cause injury or death.

Disconnect all local and remote electrical power supplies before working within the electrical enclosure.

The line side of the disconnect remains energized when the disconnect is Off.

Use a voltmeter to verify that the electrical power is Off before performing any electrical and/or mechanical service and/or maintenance operations.

WARNING

Risk of high speed moving parts. Can cause injury or death.

The fan(s) blades can start to rotate unexpectedly when the power is On. Disconnect all local and remote electrical power supplies before working within the fan compartment.

Use a voltmeter to verify that the electrical power is Off before performing any electrical and/or mechanical service and/or maintenance operations.

Each unit is shipped from the factory with all internal unit wiring completed. Refer to the electrical schematic supplied with the condenser when making line voltage supply, low voltage indoor unit interlock and any low voltage alarm connections. All wiring must be done in accordance with all applicable local, state and national electrical codes.

3.7.1 Line Voltage Wiring

WARNING

Risk electrical fire and short circuit. Can cause property damage, injury or death.

Select and install the electrical supply wire and overcurrent protection device(s) according to the specifications on the unit nameplate(s), per the instructions in this manual and according to the applicable national, state and local code requirements. Use copper conductors only. Make sure all electrical connections are tight. Unit-specific wiring diagrams are provided on each unit.

Condenser-rated voltage should be verified with available power supply before installation. Refer to the unit's electrical schematic and serial tag for specific electrical requirements.

Line voltage electrical service is required for all condensers at the location of the condenser. The power supply does not necessarily have to be the same voltage supply as required by the indoor unit connected to the condenser. See the unit's serial tag for specific condenser electrical requirements. A unit disconnect is standard on VFD and Liebert Quiet-Line Condensers and is optional on Fan Speed Control and standard Liebert Lee-Temp condensers. However, a site disconnect may be required per local code to isolate the unit for maintenance. Route the supply power to the site disconnect switch and then to the unit. Route the conduit through the hole provided in the cabinet. Connect earth ground to lug provided near terminal board.

NOTE

Liebert Lee-Temp and Liebert Quiet-Line Condensers require a separate line voltage electrical supply for the heated receivers. See ***Table 11*** *for power requirements.*

Table 8 60Hz condenser data

Model #		083, 104, 28K			165, 205, 60K			251, 308, 90K			415, 510			616			830, 1010		
# of Fans		1			2			3			4			6			8		
Input Voltage	ph	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
Fan Speed Controlled																			
208/230	1	4.8	6.0	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
460		2.5	3.1	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
575		1.9	2.4	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
208/230	3	—	—	—	8.3	9.5	15	11.8	13.0	15	15.3	16.5	20	23.6	24.8	30	30.6	31.8	40
460		—	—	—	4.2	4.8	15	5.9	6.5	15	7.6	8.2	15	11.8	12.4	15	15.2	15.8	20
575		—	—	—	3.3	3.8	15	4.7	5.2	15	6.1	6.6	15	9.4	9.9	15	12.2	12.7	15
VFD Controlled																			
208/230	3	3.7	4.6	15	7.2	8.1	15	10.7	11.6	15	14.2	15.1	20	N/A	N/A	N/A	N/A	N/A	N/A
460		1.8	2.3	15	3.5	4.0	15	5.2	5.7	15	6.9	7.4	15	N/A	N/A	N/A	N/A	N/A	N/A
Liebert Lee-Temp Controlled/Fan-Cycling																			
208/230	3	3.5	4.4	15	7.0	7.9	15	10.5	11.4	15	14.0	14.9	20	21.0	21.9	25	28.0	28.9	35
460		1.7	2.1	15	3.4	3.8	15	5.1	5.5	15	6.8	7.2	15	10.2	10.6	15	13.6	14.0	20
575		1.4	1.8	15	2.8	3.2	15	4.2	4.6	15	5.6	6.0	15	8.4	8.8	15	11.2	11.6	15

FLA = Full Load Amps; WSA = Wire Size Amps; OPD = Maximum Overcurrent Protection Device

Table 9 60Hz condenser data, Liebert Quiet-Line (Liebert Lee-Temp controlled/fan-cycling)

Model #	ph	063			119, 127, 143			214			286			409			572		
# of Fans		1			2			3			4			6			8		
Input Voltage	ph	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
208/230	3	1.8	2.3	15	3.6	4.1	15	5.4	5.9	15	7.2	7.7	15	10.8	11.3	15	14.4	14.9	20
460		0.9	1.1	15	1.8	2.0	15	2.7	2.9	15	3.6	3.8	15	5.4	5.6	15	7.2	7.4	15
575		0.7	0.9	15	1.4	1.6	15	2.1	2.3	15	2.8	3.0	15	4.2	4.4	15	5.6	5.8	15

FLA = Full Load Amps; WSA = Wire Size Amps; OPD = Maximum Overcurrent Protection Device

Table 10 50Hz condenser full load amp values

Condenser Control Type		Fan Speed Controlled		VFD Controlled		Lee Temp Controlled/Fan-Cycling		Liebert Quiet-Line (Liebert Lee Temp Controlled/Fan-Cycling)		
Model #	# of Fans	Input Voltage - Phase		Input Voltage - Phase		Input Voltage - Phase		Model #	Input Voltage - Phase	
		200/220-1	380/415-3	200/230-3	380/415-3	200/230-3	380/415-3		200/230-3	380/415-3
083, 104	1	4.0	-	3.7	1.8	3.5	1.7	063	1.8	0.9
165, 205	2	—	3.7	7.2	3.5	7.0	3.4	119, 127, 143	3.6	1.8
251, 308	3	—	5.4	10.7	5.2	10.5	5.1	214	5.4	2.7
415, 510	4	—	7.1	14.2	6.9	14.0	6.8	286	7.2	3.6
616	6	—	10.8	—	—	21.0	10.2	409	10.8	5.4
830, 1010	8	—	14.2	—	—	28.0	13.6	572	14.4	7.2

Table 11 Liebert Lee-Temp receiver electrical data, 50Hz and 60Hz

Rated Voltage - Single Phase	120			200/208/230		
Watts/Receiver	150	300	450	150	300	450
Full Load Amps	1.4	2.8	4.2	0.7	1.4	2.1
Wire Size Amps	1.8	3.5	5.3	0.9	1.8	2.7
Maximum Overcurrent Protection Device, Amps	15	15	15	15	15	15

The Liebert Lee-Temp receiver requires a separate power feed for heaters. The condenser is not designed to supply power to the receiver.

3.7.2 Low Voltage Control Wiring

NOTICE

Risk of control malfunction. Can cause improper unit operation. Make sure that all low voltage electrical wiring has been performed per the schematic diagram provided and that all low voltage wiring connections are tight.

A control interlock between the condenser and the indoor cooling units is required. Field-supplied copper wire is required for connection between like-numbered terminals 70 & 71 on both units. Wiring must be sized and selected for insulation case per NEC and other local codes. See **Tables 12** and **13** for recommended wire sizing for control wiring runs up to 150 ft (45.7m). Contact the factory for assistance with longer wiring runs. See **Figures 24**, **25** and **26** and indoor unit manual for location of terminals on condensers and indoor units.

Table 12 Minimum recommended control circuit wire size, AWG, 60Hz models

Control Wire Run ft (m)	Control Type												
	VFD & Fan Speed Controlled						Liebert Lee-Temp Only		Liebert Lee-Temp Controlled with Fan-Cycling				
	Number of Fans						Number of Fans		Number of Fans				
	1	2	3	4	6	8	1-4	6 & 8	2	3	4	6	8
0-25 (0-7.6)	16	16	16	16	16	16	16	16	16	16	16	16	16
26-50 (7.9-15.2)			16	16	14	16				16	16	16	16
51-75 (15.5-22.8)			16	16	14	14				16	16	16	16
76-100 (23.2-30.4)			16	16	12	12				16	16	16	16
101-125 (30.8-38.1)			16	14	10	12				16	14	16	14
126-150 (38.4-45.7)			14	14	10	10				14	14	14	14

Table based on 16AWG min. wire size, 0.4A per contactor, 1 to 1.5V maximum drop & 104°F (40°C) average ambient temperature

Table 13 Minimum recommended control circuit wire size, mm^2, 50 Hz models

	Control Type												
	VFD & Fan Speed Controlled						Liebert Lee-Temp Only		Liebert Lee-Temp Controlled with Fan-Cycling				
	Number of Fans						Number of Fans		Number of Fans				
Control Wire Run, M (ft)	1	2	3	4	6	8	1-4	6 & 8	2	3	4	6	8
0-7.6 (0-25)	1.0	1.0	1.0	1.0	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7.9-15.2 (26-50)			1.0	1.0	2.5	2.5		1.0	1.0	1.0	1.0	1.0	1.0
15.5-22.8 (51-75)			1.5	1.5	4.0	4.0		1.0	1.0	1.5	1.5	1.5	1.5
23.2-30.4 (76-100)			1.5	2.5	6.0	4.0		1.0	1.0	1.5	2.5	1.5	2.5
30.8-38.1 (101-125)			2.5	2.5	6.0	6.0		1.5	1.5	2.5	2.5	2.5	2.5
38.4-45.7 (126-150)			2.5	4.0	6.0	6.0		1.5	1.5	2.5	4.0	2.5	4.0

Table based on 1.0mm^2 min. wire size, 0.5A per contactor, 1 to 1.5V maximum drop & 40 °C (104 °F) average ambient temperature

3.7.3 Low Voltage Monitoring Wiring—VFD Condensers Only

Condensers with monitoring terminals may be wired with Class 1 copper wire to the indoor cooling unit or other monitoring panel. Wiring must be sized so that the voltage drop in the circuit does not exceed 1 volt. Dry contacts close when a monitored event occurs. Consult condenser electrical schematic, supplied with the unit, for details.

Contact closure on VFD Drive monitoring terminals indicates a permanent VFD fault. A factory-programmed VFD must be used as the replacement.

Contact closure on SPD monitoring terminals may indicate unit trouble ranging from electrical supply issues to SPD replacement required. A properly trained and qualified electrician is required.

3.8 Electrical Connections

Electrical service is required for all models. Electrical service shall conform to national and local electrical codes. Refer to equipment nameplate regarding wire size and circuit protection requirements. Refer to electrical schematic when making connections. Refer to **Figures 24**, **25** and **26** for electrical service entrances into unit.

A manual electrical disconnect switch should be installed in accordance with local codes. Consult local codes for external disconnect requirements.

WARNING

Risk of electric shock. Can cause injury or death.

Disconnect all local and remote electric power supplies before working in the unit. Unit contains lethal voltage in some circuits. Use voltmeter to make sure power is turned Off before making any electrical connections.

NOTE

Installation and service of this equipment should be done only by properly trained and qualified personnel who have been specially trained in the installation of air conditioning equipment.

NOTE

Use copper wiring only. Make sure that all connections are tight.

3.8.1 VFD Control Condensers Only

The installer/startup technician must determine the type of 3-phase supply power being used for the VFD Control Condenser: Wye-connected power or Delta- connected power.

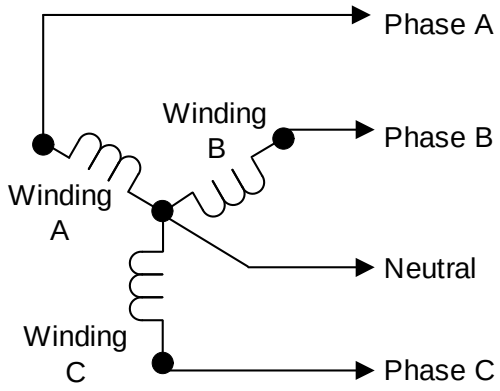
Wye-connected power has two different voltages that can be measured: Phase-to-Phase voltage (this is equal to the nominal input voltage) and Phase-to-Neutral voltage (typically used for small single phase loads (120VAC or 277VAC). See **Figure 21**.

Delta-connected power only has one voltage level that can be measured: Phase-to-Phase. See **Figure 22**.

3.8.2 Wye-Connected Power Supply

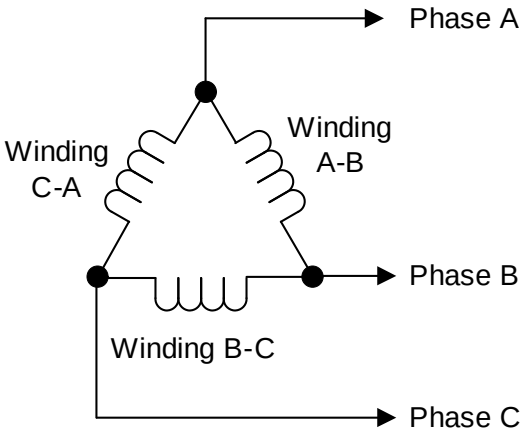
No control changes are required if the Liebert VFD Control Condenser will be operated with Wye-connected power.

Figure 21 Wye-connected power diagram



3.8.3 Delta-Connected Power Supply

Figure 22 Delta-connected power diagram

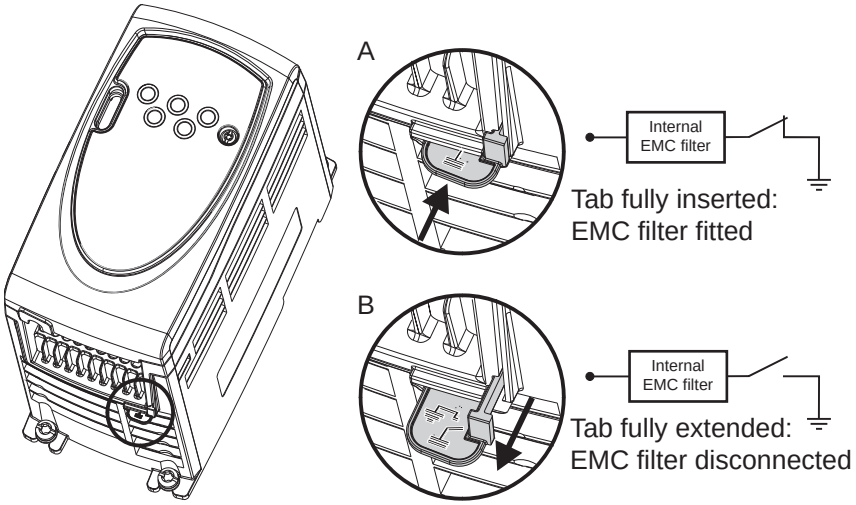


Disconnect EMC Filter for Delta-Connected Power

Installer/startup technician needs to disconnect the EMC filter on the VFD to ensure proper operation if the Liebert VFD Control Condenser will be operated with Delta-connected power.

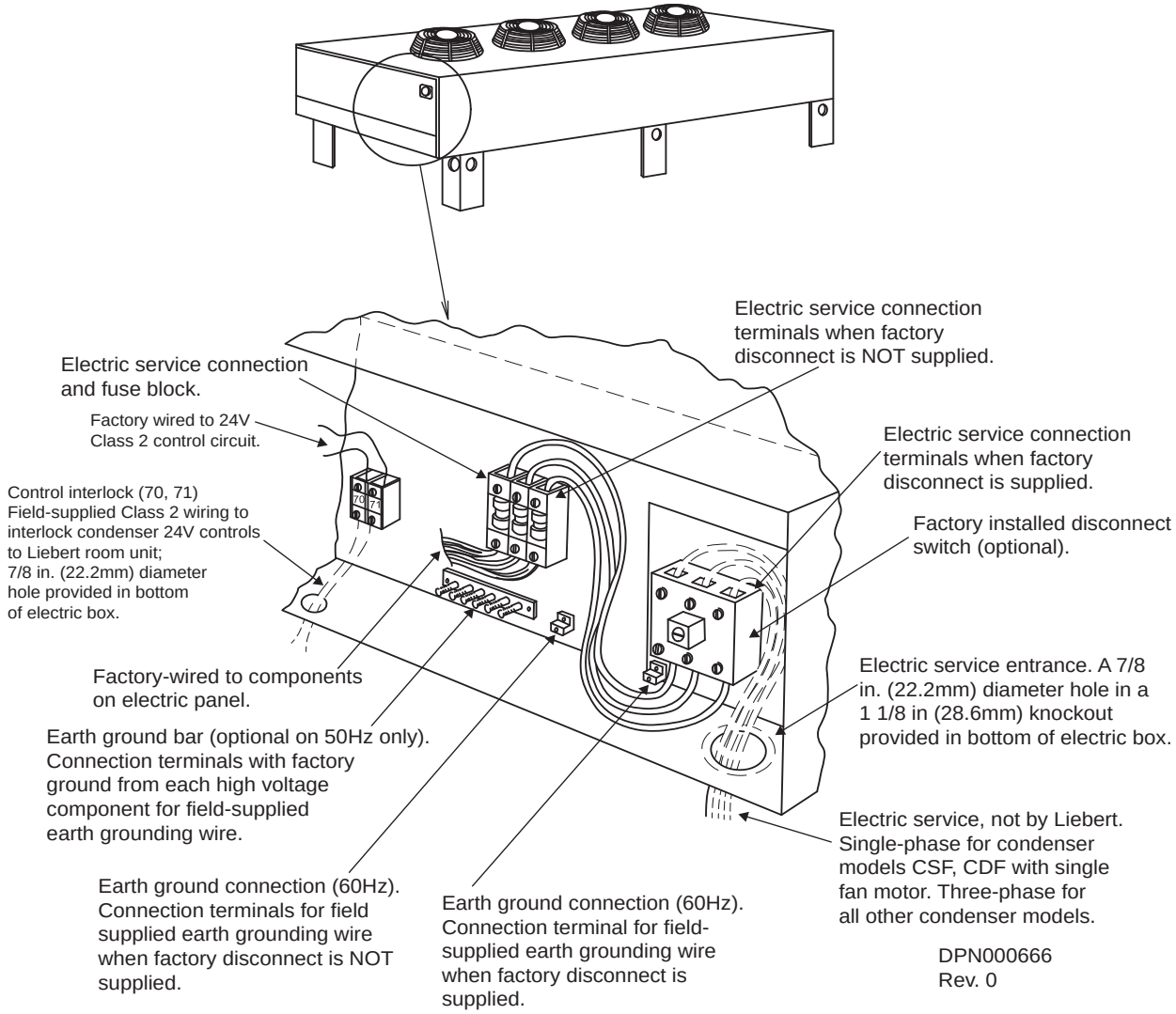
1. Disconnect the power supply before working on the unit.
2. Open the electrical panel cover and locate the VFD (Refer to **Figure 25**).
3. Using **Figure 23**, locate the small black plastic tab immediately to the right of the wiring connection block of the VFD control
4. Pull the tab to fully extend it, disconnecting the EMC filter from the circuit.

Figure 23 Disconnecting EMC filter for operation with Delta-connected power



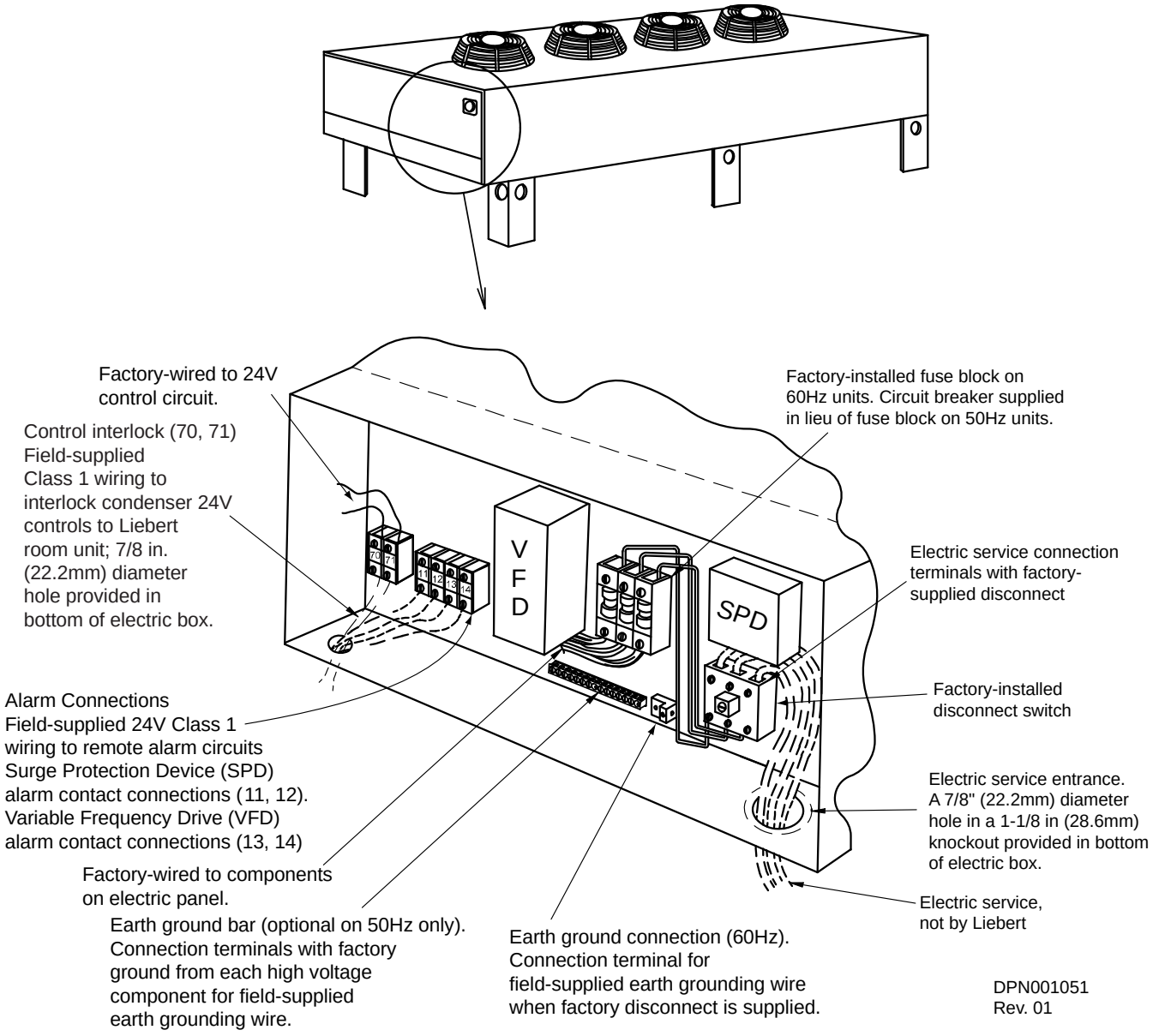
3.9 Electrical Field Connection Descriptions

Figure 24 Electrical field connections for Fan Speed Control Condensers


Electric service connection terminals when factory disconnect is NOT supplied.
Electric service connection and fuse block.
Factory wired to 24V Class 2 control circuit.
Control interlock (70, 71) Field-supplied Class 2 wiring to interlock condenser 24V controls to Liebert room unit; 7/8 in. (22.2mm) diameter hole provided in bottom of electric box.
Electric service connection terminals when factory disconnect is supplied.
Factory installed disconnect switch (optional).
Factory-wired to components on electric panel.
Earth ground bar (optional on 50Hz only). Connection terminals with factory ground from each high voltage component for field-supplied earth grounding wire.
Electric service entrance. A 7/8 in. (22.2mm) diameter hole in a 1 1/8 in (28.6mm) knockout provided in bottom of electric box.
Electric service, not by Liebert. Single-phase for condenser models CSF, CDF with single fan motor. Three-phase for all other condenser models.
Earth ground connection (60Hz). Connection terminals for field supplied earth grounding wire when factory disconnect is NOT supplied.
Earth ground connection (60Hz). Connection terminal for field-supplied earth grounding wire when factory disconnect is supplied.
DPN000666
Rev. 0

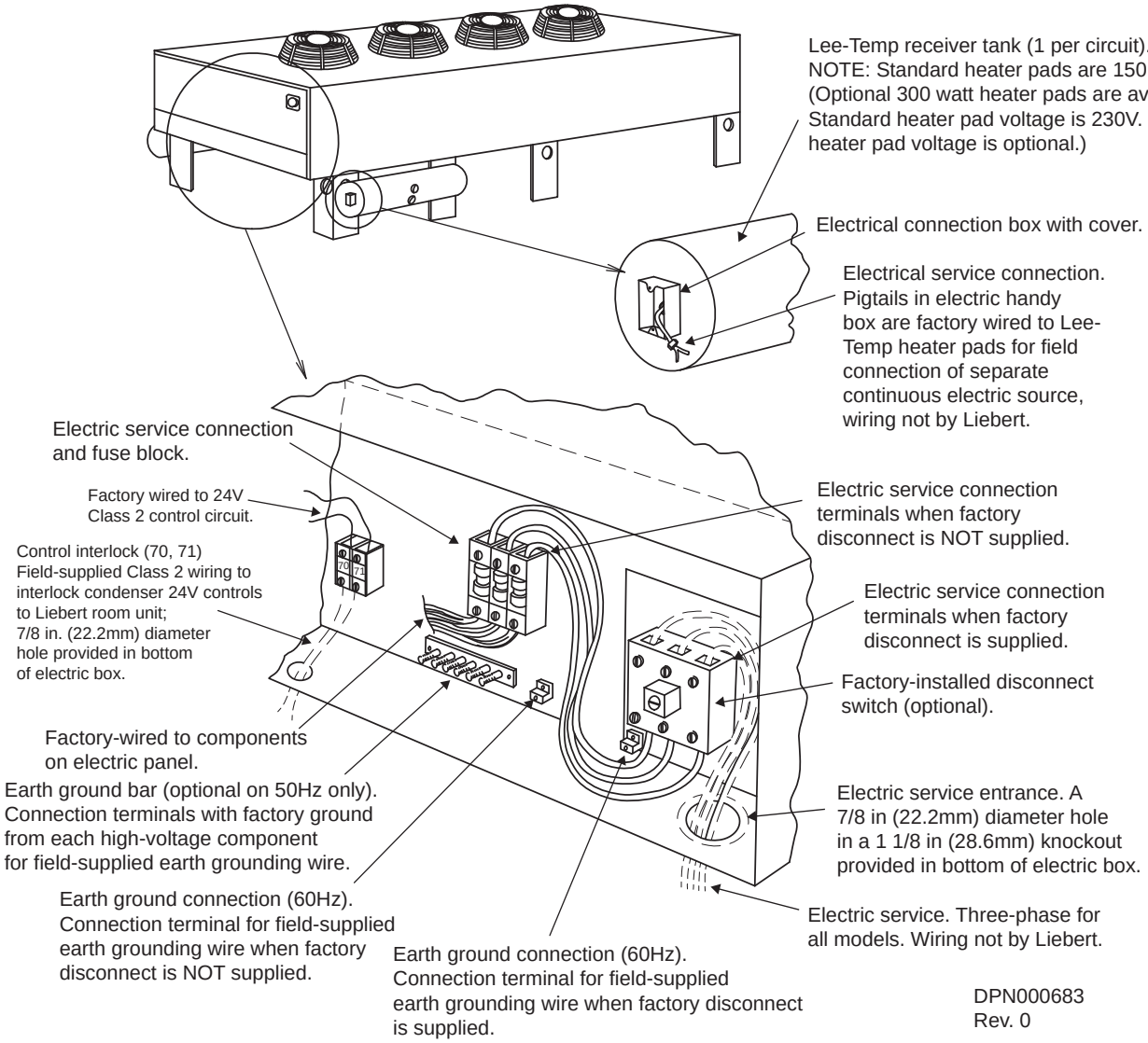
NOTE: Refer to specification sheet for full load amp. and wire size amp. ratings.

Figure 25 Electrical field connections for VFD control condensers


Factory-wired to 24V control circuit.
Control interlock (70, 71) Field-supplied Class 1 wiring to interlock condenser 24V controls to Liebert room unit; 7/8 in. (22.2mm) diameter hole provided in bottom of electric box.
Alarm Connections Field-supplied 24V Class 1 wiring to remote alarm circuits Surge Protection Device (SPD) alarm contact connections (11, 12). Variable Frequency Drive (VFD) alarm contact connections (13, 14)
Factory-wired to components on electric panel.
Earth ground bar (optional on 50Hz only). Connection terminals with factory ground from each high voltage component for field-supplied earth grounding wire.
Earth ground connection (60Hz). Connection terminal for field-supplied earth grounding wire when factory disconnect is supplied.
Factory-installed fuse block on 60Hz units. Circuit breaker supplied in lieu of fuse block on 50Hz units.
Electric service connection terminals with factory-supplied disconnect
Factory-installed disconnect switch
Electric service entrance. A 7/8" (22.2mm) diameter hole in a 1-1/8 in (28.6mm) knockout provided in bottom of electric box.
Electric service, not by Liebert
VFD
SPD
DPN001051
Rev. 01

NOTE: Refer to specification sheet for full load amp. and wire size amp. ratings.

Figure 26 Electrical field connections for Liebert Lee-Temp control condensers


Lee-Temp receiver tank (1 per circuit).
NOTE: Standard heater pads are 150 watts each. (Optional 300 watt heater pads are available.) Standard heater pad voltage is 230V. (120V heater pad voltage is optional.)
Electrical connection box with cover.
Electrical service connection. Pigtails in electric handy box are factory wired to Lee-Temp heater pads for field connection of separate continuous electric source, wiring not by Liebert.
Electric service connection and fuse block.
Factory wired to 24V Class 2 control circuit.
Control interlock (70, 71) Field-supplied Class 2 wiring to interlock condenser 24V controls to Liebert room unit; 7/8 in. (22.2mm) diameter hole provided in bottom of electric box.
Electric service connection terminals when factory disconnect is NOT supplied.
Electric service connection terminals when factory disconnect is supplied.
Factory-installed disconnect switch (optional).
Factory-wired to components on electric panel.
Earth ground bar (optional on 50Hz only). Connection terminals with factory ground from each high-voltage component for field-supplied earth grounding wire.
Electric service entrance. A 7/8 in (22.2mm) diameter hole in a 1 1/8 in (28.6mm) knockout provided in bottom of electric box.
Earth ground connection (60Hz). Connection terminal for field-supplied earth grounding wire when factory disconnect is NOT supplied.
Electric service. Three-phase for all models. Wiring not by Liebert.
Earth ground connection (60Hz). Connection terminal for field-supplied earth grounding wire when factory disconnect is supplied.
DPN000683
Rev. 0

NOTE: Refer to specification sheet for full load amp. and wire size amp. ratings.

3.10 Refrigeration Piping Connections

WARNING

Risk of explosive discharge from high-pressure refrigerant. Can cause equipment damage, injury or death. Relieve pressure before working with piping.

WARNING

Risk of refrigerant system rupture or explosion from overpressurization. Can cause equipment damage, injury or death.

Local building and plumbing codes may require that a fusible plug or other type of pressure relief device be installed in the system. Do not install a shutoff valve between the compressor and the field-installed relief device.

Consult local building and plumbing codes for installation requirements of additional pressure relief devices when isolation valves are field-installed as shown in **Figures 3** and **29**. Do not isolate any refrigerant circuits from overpressurization protection.

NOTE

POE (polyol ester) oil, required with R407C/R410A and used with some R22 systems, is much more hygroscopic than mineral oils. This means that POE oil absorbs water at a much faster rate when exposed to air than previously used mineral oils. Because water is the enemy of a reliable refrigeration system, extreme care must be used when opening systems during installation or service. If water is absorbed into the POE oil, it will not be easily removed and will not be removed through the normal evacuation process. If the oil is too wet, it may require an oil change. POE oils also have a property that makes them act as a solvent in a refrigeration system.

NOTICE

Risk of improper installation and system contamination. Can degrade system performance and damage components.

Maintaining system cleanliness is extremely important to properly complete installation and to maintain system warranty. Failure to maintain system cleanliness during piping installation will clog filter driers and adversely affect other system components such as compressors and expansion valves. Refer to **3.10.1 - Piping Guidelines** for details.

3.10.1 Piping Guidelines

Indoor units and condensers both ship with nitrogen holding charges. Do not vent the condenser until all refrigerant piping is in place, ready for connection to indoor unit and condenser.

- Use copper piping with a brazing alloy with a minimum temperature of 1350°F (732°C), such as Sil-Fos. Avoid soft solders such as 50/50 or 95/5.
- Use a flow of dry nitrogen through the piping during brazing to prevent formation of copper oxide scale inside the piping. When copper is heated in the presence of air, copper oxide forms. POE oil will dissolve these oxides from inside the copper pipes and deposit them throughout the system, clogging filter driers and affecting other system components.
- A pure dry nitrogen flow of 1-3 ft^3/min (0.5-1.5 l/s) inside the pipe during brazing is sufficient to displace the air. Control the flow using a suitable metering device.
- Ensure that the tubing surfaces to be brazed are clean and that the ends of the tubes have been carefully reamed to remove any burrs.
- Ensure that all loose material has been cleaned from inside the tubing before brazing.
- Protect all refrigerant line components within 18" (460mm) of the brazing site by wrapping them with wet cloth or suitable heat sink compound.
- Isolate piping from building using vibration isolating supports.
- Refer to indoor unit user manual for appropriate piping sizes.
- Install traps on the hot gas (discharge) lines at the bottom of any rise over 5 feet high. If the rise exceeds 25 feet (7.5m), then install a trap in 20 foot (6m) increments or evenly divided.
- Pitch horizontal hot gas piping at a minimum rate of 1/2" per 10 ft. (42mm per 10m) so that gravity will aid in moving oil in the direction of refrigerant/oil flow.
- Consult factory if Liebert Lee-Temp condenser is below the evaporator or if Fan Speed/VFD Control Condenser is more than 15 ft (4.6m) below the evaporator.
- Consult factory if piping run exceeds 150 feet (46m) equivalent length.
- Keep piping clean and dry, especially on units with POE oil (R407C, R410A or R22 refrigerant).
- Avoid piping runs through noise-sensitive areas.
- Do not run piping directly in front of indoor unit discharge airstream.
- Refrigerant oil – do not mix oil types or viscosities. Consult indoor unit for refrigerant type and oil requirements.

NOTE

Failure to use compressor oils recommended by compressor manufacturer will void compressor warranty. Consult Emerson or the compressor manufacturer for further recommendations or if you have questions about compressor oils.

Refer to ASHRAE Refrigeration Handbook for general good practices for refrigeration piping.

The Liebert indoor cooling unit has a factory-installed high-pressure safety switch in the high side refrigerant circuit. A pressure relief valve is provided with Liebert Lee-Temp condensers. Consult local building codes to determine if the Liebert Fan Speed Control (FSC) and VFD condensers will require field provided pressure relief devices. A fusible plug kit for Liebert FSC and VFD condensers is available for field installation.

3.10.2 Field Piping Installation

One discharge line and one liquid line must be field-installed for each circuit of the indoor unit and the outdoor condenser(s). Dual circuit condensers are available for most dual circuit indoor unit applications. Refer to **Figures 27**, **28** and **29** below for additional field-installed piping needed at the condenser. This piping is needed for proper system performance and for installation/interconnecting receivers and head pressure control valves for Liebert Lee-Temp systems.

NOTE

Keep the evaporator unit and condenser closed with their factory charge of dry nitrogen while all field piping is installed. Keep the field piping clean and dry during installation, and do not allow it to stand open to the atmosphere.

When all the field interconnecting piping is in place, vent the condenser's dry nitrogen charge and connect to the field piping. Finally, vent the evaporator unit's dry nitrogen charge and make its piping connections last.

*Follow all proper brazing practices, including a dry nitrogen purge to maintain system cleanliness. Refer to **3.10.1 - Piping Guidelines**.*

Figure 27 VFD and Fan Speed Control condenser piping

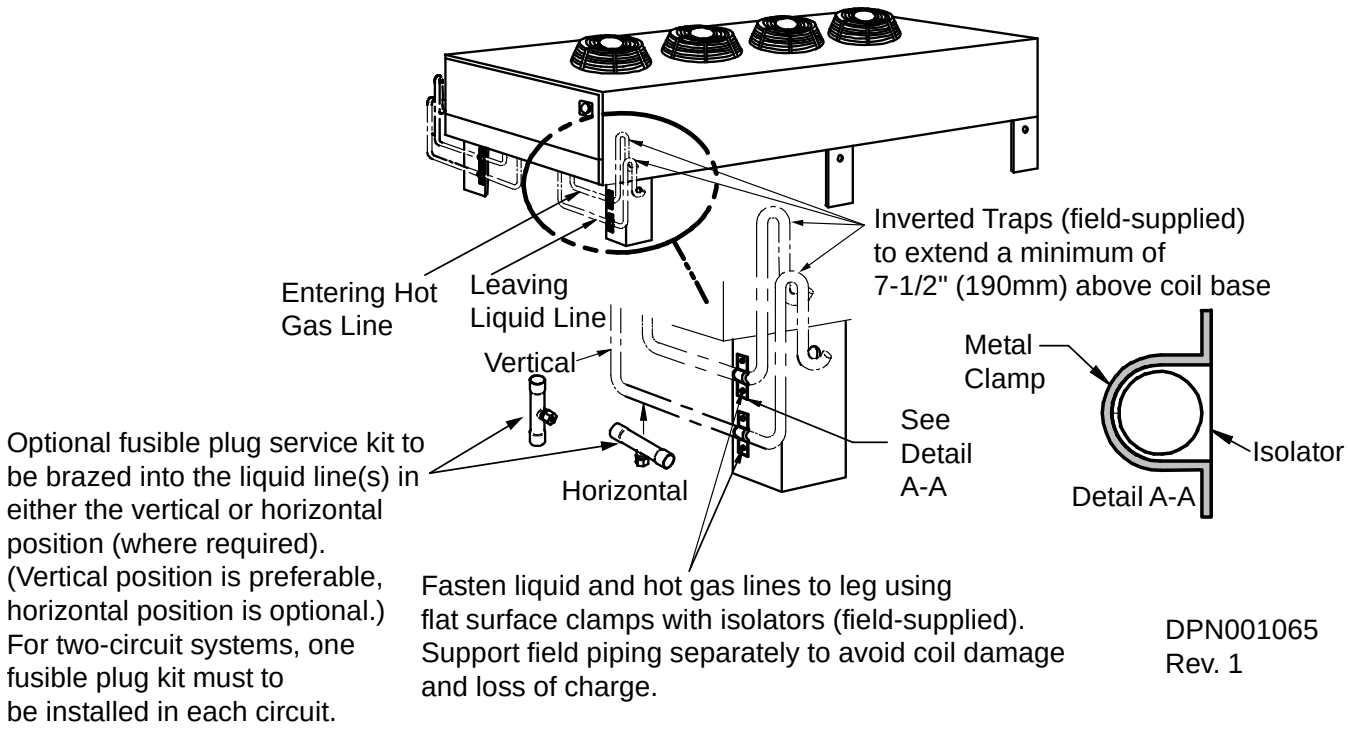

Inverted Traps (field-supplied)
to extend a minimum of
7-1/2" (190mm) above coil base
Entering Hot
Gas Line
Leaving
Liquid Line
Vertical
Metal
Clamp
See
Detail
A-A
Isolator
Detail A-A
Optional fusible plug service kit to be brazed into the liquid line(s) in either the vertical or horizontal position (where required). (Vertical position is preferable, horizontal position is optional.) For two-circuit systems, one fusible plug kit must to be installed in each circuit.
Horizontal
Fasten liquid and hot gas lines to leg using flat surface clamps with isolators (field-supplied). Support field piping separately to avoid coil damage and loss of charge.
DPN001065
Rev. 1

Figure 28 Liebert Lee-Temp head pressure control condenser piping

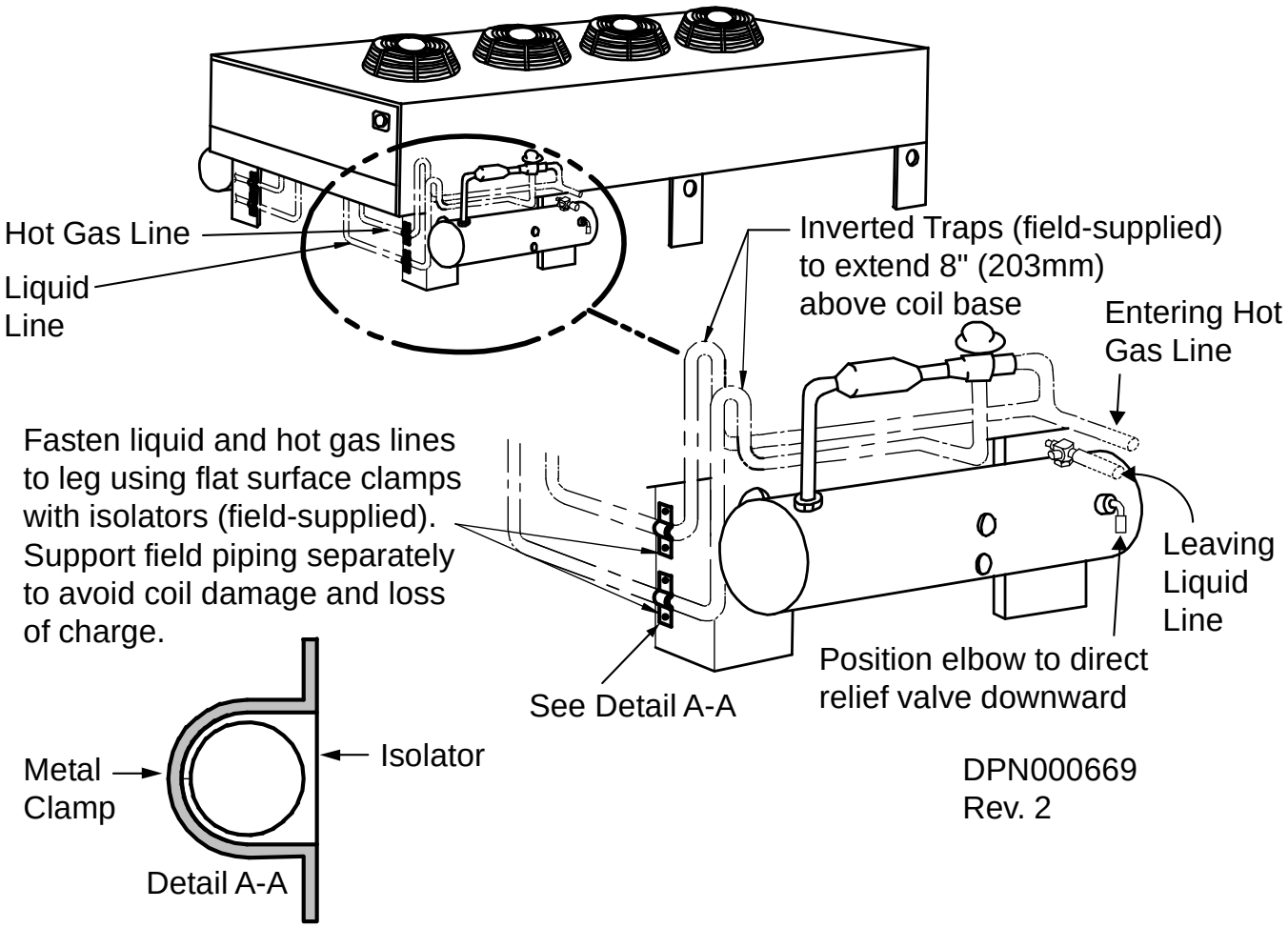
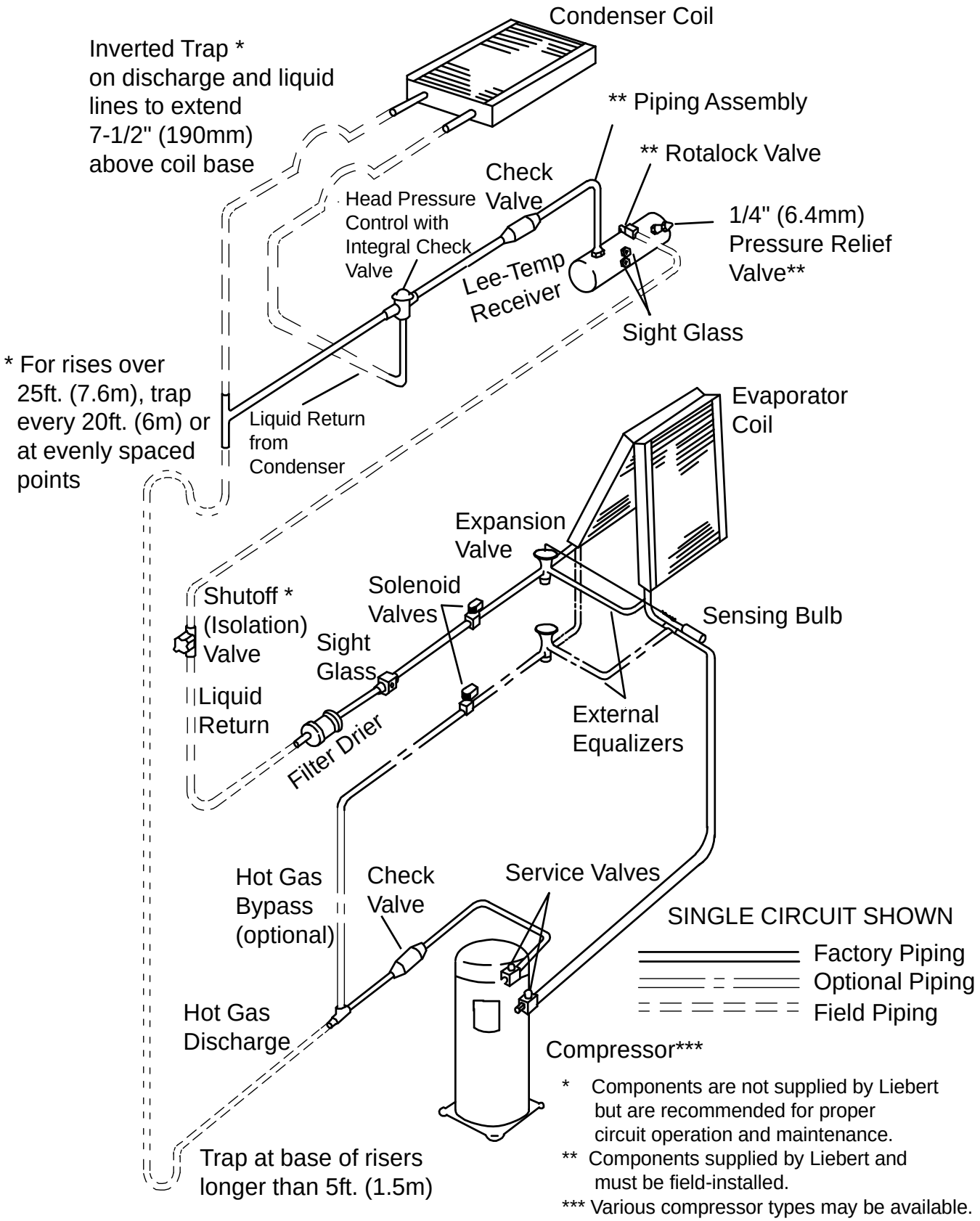

Hot Gas Line
Liquid Line
Inverted Traps (field-supplied) to extend 8" (203mm) above coil base
Entering Hot Gas Line
Fasten liquid and hot gas lines to leg using flat surface clamps with isolators (field-supplied). Support field piping separately to avoid coil damage and loss of charge.
Leaving Liquid Line
Position elbow to direct relief valve downward
See Detail A-A
Metal Clamp
Isolator
Detail A-A
DPN000669
Rev. 2

Figure 29 General arrangement—Air cooled models with Liebert Lee-Temp control



* Components are not supplied by Liebert but are recommended for proper circuit operation and maintenance.

** Components supplied by Liebert and must be field-installed.

*** Various compressor types may be available.

DPN000681
Rev. 1

3.10.3 Refrigerant Oil Addition Procedures

Consult the indoor unit's user or installation manual to determine whether additional oil is required for each circuit. Factors such as compressor, condenser type, piping lengths and total circuit refrigerant charge influence this requirement.

3.11 System Dehydration/Leak Test and Charging Procedures

Procedures for leak check and evacuation of the entire refrigeration system are contained in the indoor unit's user or installation manual. Use the proper manual section corresponding to the winter control system used on the condenser (VFD/Fan Speed Control or Liebert Lee-Temp Control) and the refrigerant to be charged into the system.

4.0 CHECKLIST FOR COMPLETED INSTALLATION

4.1 Moving and Placing Equipment

___ 1. Unpack and check received material

___ 2. Proper clearance for service access has been maintained around the equipment

___ 3. Equipment is level and mounting fasteners are tight

4.2 Electrical

___ 1. Line voltage connected and matches equipment nameplate

___ 2. Power line circuit breakers or fuses have proper ratings for equipment installed

___ 3. Control wiring connections completed between indoor cooling unit and condenser

___ 4. All internal and external high and low voltage wiring connections are tight

___ 5. VFD condensers only—Check for Delta-Connected Power Supply and make any needed adjustments per **3.8.1 - VFD Control Condensers Only**

___ 6. Monitoring wiring connections completed, when equipped, to indoor cooling unit or external monitoring panel

___ 7. Confirm that unit is properly grounded to an earth ground

___ 8. Control transformer setting matches incoming power

___ 9. Electrical service conforms to national and local codes

___ 10. Check fans for proper phase rotation. Blades should rotate clockwise when viewing the unit from the fan guard side.

4.3 Piping

___ 1. Piping is completed to corresponding indoor cooling unit refrigeration circuit.

___ 2. Piping leak-checked, evacuated and charged with specified refrigerant.

___ 3. Additional refrigerant oil added, if required, per circuit.

___ 4. Piping is properly sized, sloped and trapped for proper oil return.

___ 5. Piping is routed to reduce potential of rub-through or chaffing.

___ 6. Refrigerant lines are secured to condenser leg(s).

4.4 Other

___ 1. Fans rotate freely and in proper direction

___ 2. Adjust ambient thermostat setpoints to match setpoints on the electrical schematic supplied with the condenser.

___ 3. Foreign material removed from in and around all equipment installed (construction materials, construction debris, etc.).

___ 4. Installation materials and tools have been removed from in and around all equipment (literature, shipping materials, tools, etc.).

___ 5. Blank start-up sheet located, ready for completion by installer or start-up technician.

5.0 OPERATION

WARNING

Risk of electric shock. Can cause injury or death.

Disconnect all local and remote electric power supplies before working within. Unit contains potentially lethal electrical voltage.

Only properly trained and qualified personnel may perform repair, maintenance and cleaning operations.

The fans may start unexpectedly. Disconnect power supply before working on unit. Line side of factory disconnect remains energized when disconnect is off. Use a voltmeter to make sure power is turned off before checking any electrical connections or functions.

5.1 Startup Checklist

Refer to **4.0 - Checklist for Completed Installation** and verify that all installation items have been completed before beginning to start the condenser.

5.2 Startup

- Locate "Liebert Condensers and Drycoolers Warranty Inspection Check Sheet" (Document # SAFM-8542-54).
- Turn the condenser disconnect ON. Indoor units should be turned on and set for cooling to allow operation of condenser.
- Check the fans for proper rotation: Clockwise when viewing the unit from the fan guard (top) side. Check that air is being drawn through the coil and discharged out the fan assembly. Some ambient thermostats may need to be temporarily adjusted to lower temperature settings to observe all fans operate. Readjust thermostat settings to correspond to setpoints shown on the electrical schematic supplied with the unit.
- Complete "Liebert Condensers and Drycoolers Warranty Inspection Check Sheet" (Document # SAFM-8542-54).

NOTE

This document must be completed and forwarded to your local Emerson sales office to validate warranty.

- Contact your local Emerson sales representative or Liebert Precision Cooling support if you have any questions or problems during unit startup and commissioning.
- Local Emerson sales offices and Liebert Precision Cooling support contacts can be found at **www.liebert.com/servicesupport_pages/ServiceSupport.aspx?x=servicesupport** or by calling 1-800-LIEBERT.

6.0 SYSTEM MAINTENANCE

WARNING

Risk of electric shock. Can cause injury or death.

Disconnect all local and remote electric power supplies before working in the unit. Use voltmeter to make sure power is turned Off before making any electrical connections.

Unit contains lethal voltage in some circuits.

Only properly trained and qualified personnel may perform repair, maintenance and cleaning operations.

The fans may start unexpectedly. Disconnect power supply before working on unit. Line side of factory disconnect remains energized when disconnect is off. Use a voltmeter to make sure power is turned off before checking any electrical connections or functions.

6.1 General Procedures

NOTE

When ordering replacement parts for equipment, it is necessary to specify unit model number, serial number, and voltage. Please record those numbers in the spaces below.

- *Model Number* _____
- *Serial Number* _____
- *Voltage/Phase/Frequency* _____

Periodic attention is necessary for continued satisfactory operation of your unit. Restricted air flow through the condenser coil, reduced airflow from non-functioning fans and low refrigerant system charge levels will reduce the operating efficiency of the unit and can result in high condensing temperatures and loss of cooling. In winter, do not permit snow to accumulate around the sides or underneath the condenser coil.

Monthly and semi-annual inspections and maintenance are recommended for proper system operation. Use copies of **6.2.2 - Maintenance Inspection Checklist** for each of these inspections.

If performance or operation problems are detected at anytime, refer to **Table 14 - Troubleshooting** for required action.

6.2 Special Procedures

6.2.1 Condenser Cleaning

Keeping the outdoor condenser coils clean is an important factor in maintaining peak efficiency, reliability and long life of the equipment. It is much easier to keep up on frequent cleanings rather than wait until heavy build up has occurred which may create head pressure problems with the evaporator units.

When to Clean

Normal conditions typically dictate cleaning twice a year, spring and fall. On-site or area conditions such as cottonwood trees, construction, etc., can increase cleaning frequency. On your standard monthly preventive maintenance schedule, a visual inspection of the coil is recommended to monitor conditions.

What to Use

The best overall condenser coil cleaner to use is plain water. If the coil has been maintained and cleaned at regular intervals, water is sufficient to remove dirt and debris from the fins. Heavy build up on the exterior of the fins can be removed with a brush. Water pressure from a garden hose and sprayer usually works well. If a pressure washer is used, make sure the equipment is set to a lower pressure setting and that the nozzle is set to the fan spray, not stream. Otherwise, damage to the fins could result. If a cleaner is required, we recommend a non-acidic type cleaner be used. Acid-type cleaners can be aggressive to the coil fins as well as surrounding areas. Many sites do not allow the use of acidic cleaners for environmental reasons.

How to Clean

The absolute best way to clean coils is from the inside out. This requires disconnecting the power supply from the condenser before working on the unit. The fan guards and fan blades must be removed to gain access to the coil surface. The sprayer can then be worked across the coil using the water/cleaning solution, pushing the dirt and debris out the bottom of the coil. Although this does extend the time involved, the results are well worth it. This method should be used at least once a year. Spraying the coil from the outside repeatedly can push a majority of the dirt to the inner section of the fins and continue to restrict air flow. Keep in mind you may not have the luxury of shutting the unit(s) down for an extended time. A pre-scheduled shutdown with the operator may be in order. If you are using a cleaner along with the spraying process, follow recommended manufacturer instructions and be sure to rinse the coil thoroughly. Any residue left on the coil can act as a magnet to dirt.

Reinstall and secure the fan blades and fan guards after the cleaning is finished. Last, reconnect the power supply to the condenser.

6.2.2 Maintenance Inspection Checklist

Date:_____ Prepared By:_____

Model #:_____ Serial Number:_____

NOTE

Regular inspections are necessary to ensure that the cooling fins are clean. Should inspection reveal dirt or corrosion, appropriate cleaning should be performed.

Monthly	Semiannually
Condenser	**Condenser**
___ 1. Coil surfaces free of debris	___ 1. Complete all monthly items
___ 2. Fans free of debris	___ 2. Piping in good condition
___ 3. Fan motors securely mounted	___ 3. Inspect refrigerant lines for signs of oil leaks. Repair leaks as found.
___ 4. Motor bearings in good condition	___ 4. Check refrigerant charge level in each receiver tank (if equipped), based on procedures in the indoor unit's manual. Continuous system operation required.
___ 5. Check all refrigerant lines and capillaries for vibration isolation. Support as necessary.	___ 5. Wash coil as needed
___ 6. No refrigerant leaks.	___ 6. Repair bent or damaged fins.
Condenser Electrical Panel	**Condenser Electric Panel**
___ 1. On VFD condenser models, check SPD protection status indicator light.	___ 1. Check all electrical connections
	___ 2. Check contactors for pitting
	___ 3. Operational sequence/setpoints
	Fan Motors
	___ 1. Motor #1 amp draw _____ amps
	___ 2. Motor #2 amp draw _____ amps
	___ 3. Motor #3 amp draw _____ amps
	___ 4. Motor #4 amp draw _____ amps
	___ 5. Motor #5 amp draw _____ amps
	___ 6. Motor #6 amp draw _____ amps
	___ 7. Motor #7 amp draw _____ amps
	___ 8. Motor #8 amp draw _____ amps

Notes _____

Signature: _____

Make photocopies of this form for your records

Table 14 Troubleshooting

Symptom	Possible Cause	Check or Remedy
Condenser will not start	No power to condenser	Check voltage at input terminal block
	Circuit breaker for low voltage transformer in condenser is tripped	Locate problem in condenser electrical panel and repair
	No low voltage signal to/from indoor unit	Locate open circuit and repair
Low indoor unit suction pressure	Insufficient refrigerant in system	Check for leaks, repair, and add refrigerant
	Fan-cycling ambient thermostats setpoints too low	Check schematic for recommended setpoints and adjust.
Low discharge pressure	Faulty head pressure control valve or condenser FSC/VFD control	Replace if defective
High discharge pressure	Dirty condenser fins	Clean coil
	Condenser fans not operating	Check for low voltage signal from indoor unit
		Check fan motors and fuses
		Check for correct ambient thermostat setpoints, as applicable.
	High refrigerant charge	Check refrigerant charge
VFD Condenser trips out on overvoltage (**OU** displayed on VFD controller)	Supply voltage is Delta configuration or is ungrounded/high impedance	Shut off AC voltage, locate the VFD, pull out the EMC tab and reconnect power
SPD indicator lights are extinguished or red LED is illuminated and monitoring terminals 11/12 are closed	No voltage or improper phasing exists at condenser	Check voltage at input terminal block
	Electrical connections to SPD are faulty	Locate connection problem and repair
	A surge exceeding the rating of the SPD has occurred	Replace SPD and inspect other components for damage and replace them if necessary

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